The Refrigeration Service Engineer

Vol. 6
No. 7

JULY • 1938

THE JOHN CRERAR
JUL 16 1938
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From All Points—

UTICA, N. Y.—I have used plenty of Rotary Seals in the past with very good results, both as to a good job and a real profit maker.
William Bodmer, 1124 Kellogg Ave.

DETROIT, MICH.—I find the Rotary Seal is a great time saver for me.
L. J. Hacker, 5344 Canton St.

NEWARK, N. J.—I think there is nothing like your Rotary Seals. I use from 12 to 15 every week. *D. Van Valkenburgh, 25 Elliott St.*

MILWAUKEE, WIS.—I find the Rotary Seal works out the best of any I have found. With the proper installation, they always work fine.
Ross O. Hughes, 500 E. Ogden Ave.

CINCINNATI, OHIO—I have used your Rotary Seals over a period of 18 months and as I have not had a call back on one of them, I am using them on all seal leaks now.
M. F. Carty, 6034 Lockard St.

MIAMI, FLA.—I have found that Rotary Seals are more reliable and easier to install with a minimum of both time and expense insuring satisfied customers.
H. V. Flood, 1313 N. W. 80th St.

SAN JOSE, CALIF. Out of the hundreds of Rotary Seals I have used none have failed due to the seal itself.
Harry M. Barnes, 670 Lincoln Ave.

ST. LOUIS, MO.—I think Rotary Seals are far superior to all other makes. They are a great time saver, easy to install, have a long life and make satisfied customers.
Harold Boatright, 4973 Fountain Ave.

CHICAGO, ILL.—The use of Rotary Seal Replacement Units has meant a quicker, more economical, and more reliable job.
Wayne McCormack, 2915 W. Madison St.

WASHINGTON, D. C.—Rotary seals are easily and quickly installed, forming a positive leak-proof shaft seal.
J. W. Holland, 1123 E. St., N. E.

PITTSBURGH, PA.—The Rotary Seal is the most satisfactory seal I have ever used. It stands up well and is easily installed.
H. A. Bortz, 613 Worth St.

ST. PAUL, MINN.—Have not had a failure yet. Think they are fine.
W. P. Nelson, 37 E. Wyoming St.

WESTERLY, R. I.—I have been using Rotary Seals for a number of years and have had very good service from them.
Alexander Taylor, Jr., 234 High Street.

NEW ORLEANS, LA.—We have been using Rotary Seals for a considerable length of time and have found them most satisfactory in every respect. *Frigid Refrigeration Service, 1210 St. Charles Ave.*

WAYNESBORO, VA.—I have used your seals for two years and find them entirely satisfactory. The main reason I like them is because they can be installed in the field.
C. H. Kirk, 202 Arch Avenue.

BALTIMORE, MD.—Our experience over a period of three years in using Rotary Seals has been very satisfactory. We can recommend them to all service men.
Robert Fischer, 609 E. 25th St.

NEWPORT, KY.—Twelve years in the refrigeration service work. Your seals are O.K. Recently one of your units saved me from buying a new pump. *J. L. Meyers, 18 Parker Rd.*

PORTLAND, CONN.—In my fourteen years of experience working on all type of refrigeration and coming in contact with all types of seals, I can safely say that the Rotary Seal far surpasses all others; easier than any other to install and very dependable.
Wm. A. Neary, 20 Commerce St.

ANDERSON, S. C.—We had very good experience with using your Seal replacements and have been using them for several years in our service work and are very well pleased.
Richard Ruhle Refrigeration Co.

HONOLULU, T. H.—Am very pleased to express my opinion on your Rotary Seals. I have been using your Rotary Seals since 1935 and have found none defective. Also, all of them are working in excellent order. No salesman can make me change to another. Am more than satisfied with them.
Harold H. Jeffs, 1156 Alapai St.

SPRINGFIELD, MASS.—My experience with Rotary Seal Replacement Units has been very satisfactory. They help us to give quick and efficient service.
Geo. F. Allen Refrigeration Service, 51 Orlando St.

WINNIPEG, MANITOBA, CANADA—I believe your seal is the most practical and serviceable seal on the market today.
F. Hathaway, 366 River Ave.

BROOKLYN, N. Y. The efficiency of your Rotary Seals has proven to be a great time saver. *Geo. Gaydos, 423 53rd St.*

THE REFRIGERATION SERVICE ENGINEER, Nickerson & Collins Co., Publishers, 435 N. Waller Ave., Chicago, Ill., Published monthly. Vol. 6, No. 7, July, 1938. Entered as second class matter March 4, 1938, Chicago, Ill., under the Act of March 3, 1879. Subscription in United States, $2.00 per year; all other countries, $3.00 per year.

The Reports are the Same

SAN FRANCISCO, CALIF.—I find the Rotary Seal to be most satisfactory in my line of work. *A. Huthmacher, 1915 Fulton St.*

HARTFORD, CONN.—In my experience I have found the Rotary Seal the ideal thing. They eliminate callbacks which gives employers a bad opinion of their service man. Rotary Seals wear themselves to a perfect fit on every job. *John LaBella, 49 Eaton St.*

FT. LAUDERDALE, FLA.—We have been using your Rotary Seals for the past year and have found them very dependable. The service men prefer to install them to some other makes. Last but not least the price is also an inducement. *C. P. Purdy, 1 S. E. 2nd St.*

SPRINGFIELD, ILL.—We find Rotary Seals give the best of service. Our replacement is 100% Rotary. We use approximately 100 seals a year.
A. W. Sikking Co., 116 N. Sixth St.

MORRISVILLE, VT.—For a minimum of time, expense and call-backs, I can find no substitute for Rotary replacement seals.
Wallace R. Jackson.

ST. LOUIS, MO.—Speaking of Refrigerator Seals, there is only one leader, and that is Rotary Seal.
Arthur E. Young, 7534 Canton Ave.

WINSTON-SALEM, N. C.—We have used a large number of Rotary Seals and find that they save enough time in labor to completely pay for the seal. The first one has yet to give us trouble after installation.
L. M. Jones, % C. R. Williams Radio Co., 211 S. Liberty St.

BROOKLYN, N. Y.—I have had a long experience with your seals and found that they are long lasting and secure.
Ray Cameron, 323 Schermerhorn.

SPRINGFIELD, OHIO—I have been using "Rotary Seals" for the past five years. I can surely recommend them very highly; in fact, I'll go so far as to say, that, I think they are the best available.
L. E. Brumfield, 2414 Woodside Ave.

JACKSON HEIGHTS, N. Y.—The continual use of Rotary Seals by myself and my fellow workers, speaks more praise than any words I could write.
E. Amsterdam, 40-71 Elbertson St.

AITKIN, MINN.—I like Rotary Seals very much. As soon as they are installed, there is no more seal trouble. *E. W. Richards.*

LEXINGTON, KY.—I find that Rotary Seals are very easy to install and give perfect satisfactory service.
A. R. Gaines, 404 Kenilworth Ct.

CINCINNATI, O.—I have found Rotary Seal Replacement Units very satisfactory in all Installations which I have made.
R. L. Todd, 6818 Windward St.

CAMBRIDGE, MASS.—We have used several hundred Rotary Seals and have had satisfactory results with all of them.
Miller & Seddon Co., Inc., 2089 Massachusetts Ave.

NEWPORT NEWS, VA.—We have been using Rotary Seals since first placed on the market, and have not had a single failure. We will not use any other seal.
W. W. Poindexter, 905 Twenty-fifth St.

MILWAUKEE, WIS.—We have been using Rotary Seal Replacements for a number of years, and we find them easy to install, no time wasted, satisfactory in every way. Whenever it's a seal replacement, it's a Rotary for our Refrigeration service work.
R. W. Nelson, A-1 Refrigerator Repair Co., 1927 S. 6th St.

TRINIDAD, COLORADO.—In service work time saved on a job is the same as so much money, and dependability means customer satisfaction. Satisfied customers are the keystone of a lasting and successful service business—this being the reason why I pick Rotary Seal for every seal job.
W. M. Thomas, 616 Pine St.

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F. A. Keys, 1545 Taylor St.

BROOKLYN, N. Y.—After unsuccessful experimentation with various types of seals, we are pleased to say that we have not found another replacement seal that insures the quality and successful operation that is available in your Rotary Seal Replacement Unit.
Blake Refrigeration Service Co., 530 E. 93d St.

WASHINGTON, D. C.—I have found your seals to be very satisfactory.
R. N. Gerren, Jr., 37 Rhode Island Ave., N.W.

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Perkis Brothers, 9917 Walden Parkway.

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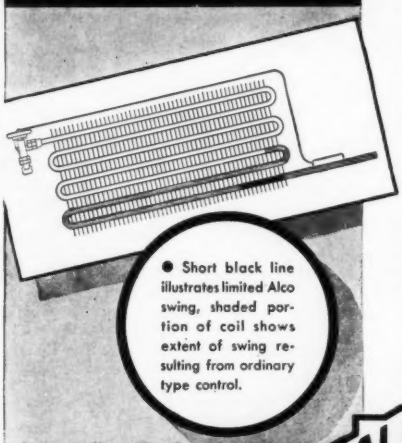
A wide swing—poor control and a wasted opportunity to score.



● Short black line illustrates limited Alco swing, shaded portion of coil shows extent of swing resulting from ordinary type control.

● Alco Thermo Valves, by eliminating wide, wasteful swings in the line of complete evaporation, will produce the greatest efficiency in your evaporator. Alco Thermo Valve control increases the over-all suction pressure, increases compressor capacity, reduces running time and prevents the return of liquid refrigerant to the compressor.

You need the kind of control that only Alco can supply. Ordinary control allows wide variations in the line of complete evaporation — it permits swinging or surging, with liquid returning to the compressor one instant and in only a part of the coil the next. The diagram illustrates the extent of these costly, inefficient swings and shows the "straight line" control of Alco. Alco Thermo Valve control keeps the line of complete evaporation within the narrowest of limits at all times utilizing a maximum of coil surface with a resulting increase in capacity.

Widely known throughout the industry, Alco Thermo Valves are carefully engineered, precision manufactured and thoroughly tested under all possible operating conditions. The experience of Alco engineers is second to none in the entire field of refrigerant control.

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Phosphor bronze disc reinforces top of Sylphon
Swivel button relieves twisting strain from sylphon
Wheel fits pa
Handle swedged and securely locked to bonnet.
Steel nut makes firm, sure seal between bonnet and body.
Short, husky stainless steel stem will not bend. Held open by large bronze spring.
Special spring loaded packing holds gases whether valve is in open, closed or partially open position and prevents pulsations from reaching Sylphon.
Extra large approved bronze Sylphon with soft copper flange to make tight joint under bonnet. Sylphon travel restricted to less than its capacity and extra deep convolutions prolong life to more than 100,000 cycles.
60° seat assures a positive and easy seating action.
All seats protected with lead protectors until used.
Raised portions of base form socket which takes twisting strains when wrench is used on valve.

Imperial SYLPAK VALVES

have proved to be the practical answer to the valve problem

OUT of all the operating experience with so-called packless valves and valves with trick packings, has come a definite swing to Imperial Sylpak Valves. This valve, as shown by the accompanying sectional view, offers the double security of the sylphon plus a good spring-loaded packing. The brass forged body is non-porous, strong and uniform and has full size openings.

The Sylpak is a valve that stays tight under *every* operating condition . . . It stands up under pulsations, vibration, excess pressure and can be used with any refrigerant excepting ammonia.

Actual tests, made both in the Imperial engineering laboratory and by the Underwriters Laboratories have shown that these valves will withstand over 100,000 opening and closing operations. And even in the event there should be an occasion to change a sylphon, this can be easily done with the Sylpak while the valve is under pressure.

Despite their special advantages and premium quality, these Imperial Sylpak Valves cost no more than ordinary packless valves. It is no wonder, therefore, that service men in constantly growing numbers are specifying these better designed and better made valves by name when ordering. Imperial Sylpak Valves have shown that they will meet every requirement of present day standards of air conditioning and refrigeration work.

These valves are available for tube diameters from ¼" to ⅞" for S. A. E. or solder fittings as desired. Sylphon type valves can also be furnished in sizes up to 1½" female I. P. T. and 1⅝" O. D. tube size.

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THE GREATEST "CITY WITHIN A CITY" THE WORLD HAS EVER KNOWN

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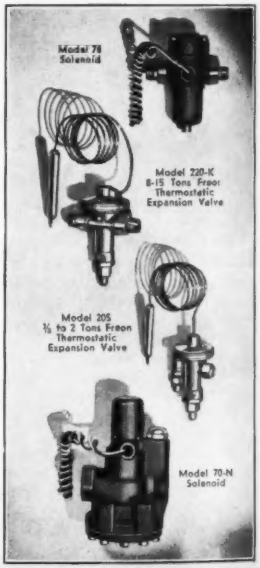
2. La Maison Francaise.
3. British Empire Building.
4. 41-story International Building.
5. Palazzo d'Italia.
6. International Building East.
7. Radio City Music Hall.
8. 31-story RKO Building.
9. 36-story Nine Rockefeller Plaza Building.
10. Center Theater.

GO TO YOUR JOBBER FOR YOUR AP CONTROLS

The responsibility for mechanical operation in every one of Rockefeller Center buildings is an enormous one. Air Conditioning and Refrigeration equipment alone runs into hundreds of thousands of dollars. The fact that A-P Thermostatic Expansion Valves and Solenoids have been chosen to control this vast investment speaks well for the National and International recognition accorded A-P Controls by the greatest of the country's Engineers and Builders.

A-P Valves can always be depended upon for efficient, accurate, economical Refrigeration and Air Conditioning Control. The largest installations in the country prove this fact beyond question.



● Progressive Jobbers Everywhere Stock A-P Controls.

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MILWAUKEE WISCONSIN

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THE BYWORD FOR A-P CONTROLS

MEETS THE MOST EXACTING DEMANDS ★

● Service engineers, installation and repairmen everywhere are realizing more every day that Mueller Brass Co. TIME-TESTED accessories mean greater profits to them through greater customer satisfaction—

BECAUSE: The Mueller Brass Co. TIME-TEST all of their refrigeration accessories at their testing and experimental laboratories before placing them on the market. The Mueller Brass Co. control every phase of manufacture of all their products from raw materials to the finished accessory.

Quality is the first and last consideration in the design and manufacture of all Mueller Brass Co. mechanical refrigeration accessories.

Write us for literature. Order through your jobber.

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MUELLER BRASS CO.
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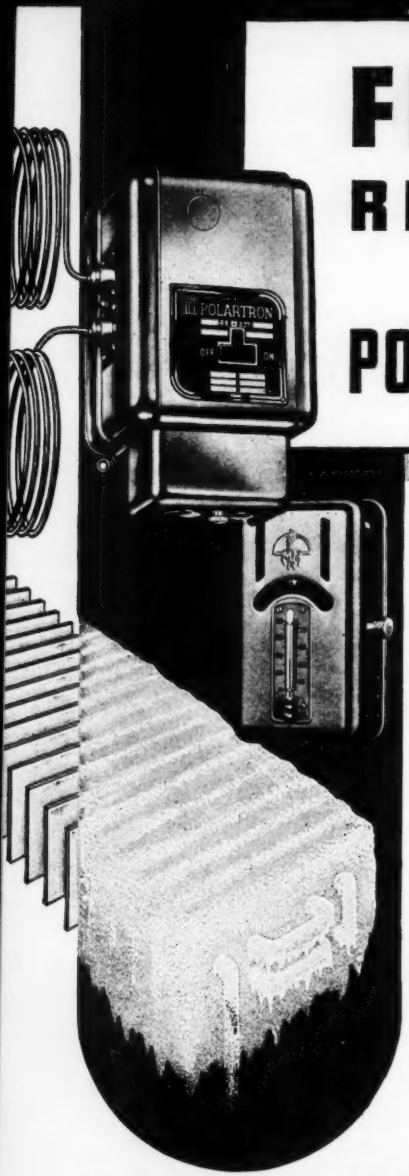
VALVES FITTINGS ACCESSORIES *for* AIR CONDITIONING *And* REFRIGERATION

FROST-FREE REFRIGERATION *with the* POLARTRON *Control System*



While the Polartron System insures "Frost Free" Refrigeration for above freezing temperatures, the Polartron Controller, used alone, provides new standards of adjustment and safety for refrigeration at any degree.

. . . . . *Icy Coils* ROB YOUR CUSTOMERS

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THE POLARTRON SYSTEM WILL MAKE SATISFIED CUSTOMERS AND NEW PROFITS FOR YOU

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The Polartron is covered by issued and pending patents

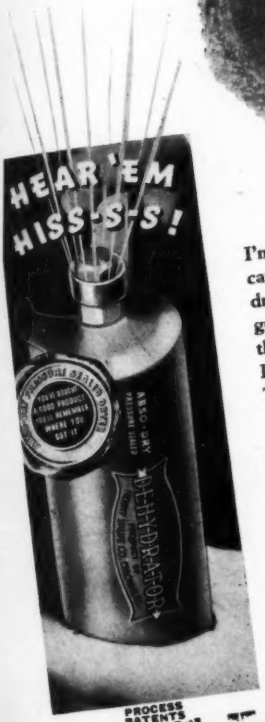
AUTOMATIC CONTROLS MH

MINNEAPOLIS-HONEYWELL

BROWN INDUSTRIAL INSTRUMENTS
NATIONAL PNEUMATIC CONTROLS

Control System

EVERYBODY KNOWS HOW DRY I AM !



PROCESS PATENTS (Applied For)

I'm the only dryer that can really show how dry I am because when my seal cap is loosened, I *hiss*. I'm vacuum dried and pressure sealed with dehydrated air, and Henry guarantees me to remain in factory-dry condition right up to the time you remove my seal cap and install me in a system. I'm exclusive, yet I cost no more than ordinary dryers. There are no doubts about *my* drying value.

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"Every trace of moisture has been removed from this dryer by the exclusive Henry Vacuum Process. When the seal cap at the inlet end is removed, there is a hissing sound due to the escape of dehydrated air. This is your guarantee that the dryer has reached you in the same condition as when it left the factory and that original drying efficiency has not been impaired. *If this dryer does not hiss, your jobber is authorized to exchange it for a new one.*"

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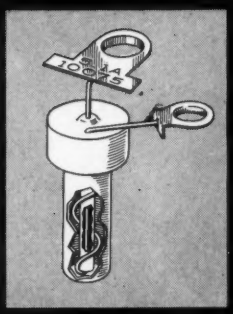

Ranco OVERLOAD PROTECTION

Always on the Job Never in the Way!

RANCO overload protection is *positive* protection. The Ranco heater coil is completely imbedded in ceramic material which gives the coil a permanently exact location on the inside of the solder well. "Positioning" of the coil is never required. And in the event of overload the coil transmits its heat uniformly to the metal parts of the solder well, insuring consistent tripping point in direct proportion to the coil rating.

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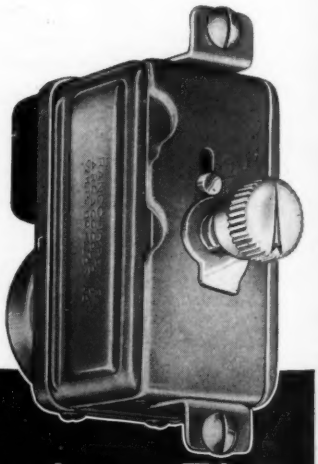
Ranco refrigerator thermostats are built to save the time of service men. Stainless Steel for strength—positive overload protection—outstanding simplicity of construction and ease of adjustment! In addition, more EXACT REPLACEMENTS than any other line.

Before starting work on the thermostat replacement for any make or model of refrigerator, check first and see if there isn't a Ranco control that is *exactly* what you need. Write for Bulletin. Complete export information furnished on request.



Ranco INC. Columbus, Ohio

The Refrigeration Service Engineer

Vol. 6 No. 7

July, 1938

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

Cover

This month's front cover shows a modern building exterior, and a locker room of one of the newest and fastest growing industries—the locker storage plant. This issue contains another interesting article on the subject of these plants, as found in the state of Oregon.

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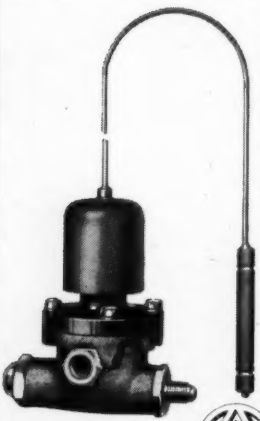
Experience measured in millions



There have been more than three million Detroit Expansion Valves turned out since the unit on the left was built 8 years ago. Practically every year since then there has been some worth while improvement in valve design added to the Detroit line. This line today incorporates every improvement applicable in modern refrigeration practice.

Take advantage of your jobbers cooperation

GAS CHARGED POWER ELEMENTS

Protect motor by preventing overload. Provide instant action with no temperature lag. Keep the entire system in perfect balance at all times.

★

DOUBLE DURAFLEX BELLOWS

Special alloy bellows resists corrosion, is highly flexible for maximum sensitivity. High resistance to fatigue assures maximum service life. Balanced bellows construction permits consistent superheat setting over wide pressure range.

★

STAINLESS STEEL SPACER

Stainless steel is used instead of bakelite because of greater strength. It is equally as good in insulation value.

★

DELUBALOY NEEDLES AND SEATS

Especially hard alloy that resists corrosion and wear—assures tight shut-off and gives years of extra service life.

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FLOATING NEEDLE CONSTRUCTION

Self-aligning needle construction eliminates wear due to side thrust and wiping action against the seat and prolongs service life of the valve.

★

CONVENIENT STRAINER DESIGN

Patented strainer construction. Strainer or gasket will not drop out when flare nut is removed.

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The Refrigeration Service Engineer

VOL. 6, No. 7 CHICAGO, JULY, 1938 $2.00 per Annum

Service Data on The Crosley Refrigerator

Complete Information on the Model T-1 and T-5 Units Manufactured in 1937-38

THE 1938 line of Crosley refrigerators includes both Standard and DeLuxe Shelvador household refrigerators and Koldrink bottle coolers. The Standard models are designated as the "KB" line; the DeLuxe models, which differ in accessories and appointments, are known as the "KL" line.

Three types of units are employed in 1938 Crosley refrigerators. For convenience, these are classified and distinguished according to the type of compressor used. These compressors, with their designating symbols are:

The T-5 compressor, illustrated in Fig 1, uses Freon-12 (F-12) as a refrigerant and is hermetically sealed with every fitting and joint brazed or welded. On units employing T-5 compressors, the compressor is similarly connected to the rest of the refrigerating system; that is, through tubing permanently brazed or soldered to the compressor and other parts. The T-5 is of the reciprocating piston type with a built-in ⅛ hp. capacitor start motor and a scotch-yoke mechanism for operating the piston.

The Q-3 compressor is of the conventional open style, single cylinder, reciprocating type. It uses SO_2 as a refrigerant and incorporates several exclusive features that simplify its construction and reduce service trouble. The Q-3 compressor is operated with a twin belt drive from the motor.

The Q-1 compressor is the same as the Q-3, except that a single belt drive is employed.

The 1937 line of Crosley refrigerators included the T-1 model compressor (Fig. 2) which is of the semi-hermetically sealed type, with still air condenser and a capillary tube.

Since the Q-3 and 1 units are essentially the same as those manufactured in earlier years, and an article on them appeared in a past issue of this journal, we will not consider them here.

The T-1 unit was first manufactured in 1936. The T-5 unit was introduced in 1937.

Operation of T-5 System

Starting at the evaporator, it will be noted that the refrigerant leaving the evaporator, in the form of cool low pressure gas is drawn up the suction tube to the heat exchanger. This is located inside the chamber and is surrounded by liquid refrigerant. From the heat exchanger the gas is drawn into the compressor.

After entering the compressor the gas

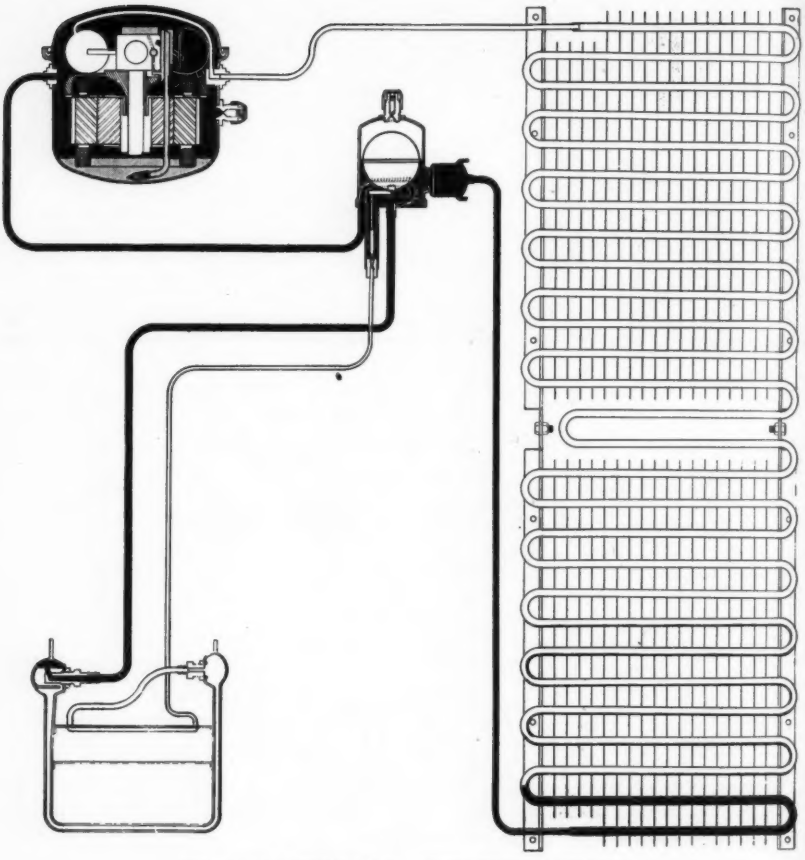


FIG. 1—1938 CROSLEY T-5 UNIT SYSTEM CHART

goes through the intake muffler assembly and into the cylinder where it is compressed by the piston and forced out through the exhaust muffler into the discharge tube. The gas is now under considerable pressure and is quite hot due to its compression in the cylinder.

The compressed gas travels through the discharge tube to the condenser, where it gives up a large part of its heat to the surrounding air. This cooling, together with the high pressure, permits the hot gas to liquefy in the lower portion of the condenser. From the condenser the liquid refrigerant passes through the dryer, whose purpose is to remove any slight moisture, which might be present.

Leaving the dryer the refrigerant next enters the float valve chamber. After a sufficient amount of the liquid refrigerant accumulates in this chamber, the float ball, being buoyant, is raised up. When this occurs, the float needle, which is connected to the ball through a linkage, is also raised, permitting the liquid to flow through the float valve orifice into the evaporator intake tube. In flowing through the float valve assembly the liquid refrigerant is reduced in temperature by the cool vapor being drawn through the heat exchanger on its way back to the compressor.

The liquid refrigerant entering the evaporator is now under low pressure due to the restriction afforded by the float valve and

the low pressure maintained by the compressor in the return or suction line. This low pressure permits the refrigerant to vaporize in the evaporator and in so doing extracts heat from the surrounding air in the cabinet, producing refrigeration.

REFRIGERANT AND OIL CHARGES—
1937 & 1938 UNITS

UNIT	COMPR.	REFRIG.	OZ. OF REFRIG.	OZ. (FLUID) OF OIL
*943, 9431	Q-3	SO_2	15	10
*953, 9531	Q-3	SO_2	15	10
*973, 9731	Q-3	SO_2	15	10
938, 9381	Q-1	SO_2	28	10 3**
908	Q-1	SO_2	12	10
902	Q-2	F-12	8	10
*941	T-1	SO_2	17	32
*951	T-1	SO_2	17.5	32
*961	T-1	SO_2	18	32
931, 9311	T-1	SO_2	29	32 3**
*945, 9451	T-5	F-12	35	25
*955, 9551	T-5	F-12	37	25
*975, 9751	T-5	F-12	37	25
935, 9351	T-5	F-12	31	25
K-35	T-5	F-12	30	25
K-45	T-5	F-12	32	25
K-55	T-5	F-12	32	25
K-75	T-5	F-12	32	25
K-43	Q-3	SO_2	16	10
K-53	Q-3	SO_2	16	10
K-73	Q-3	SO_2	16	10

* Late type units, with accumulators.
** Oil in Evaporator in addition to that contained in the compressor.

Servicing Units with T-5 Compressors

The T-5 compressor uses Freon-12 (dichlorodifluoromethane) and is completely hermetically-sealed. Units using this compressor cannot be serviced by either the distributor or dealer where the refrigerating system is affected, other than repairing leaks. Such separate parts as the temperature control, relay, capacitor and wiring, which may be removed without opening the refrigerating system, can be replaced in the field. The T-5 is a reciprocating type of compressor with forced feed oiling by means of a piston pump. The rotor and shaft of the motor are supported by a long single main bearing. The motor used is a ⅛ hp. capacitor start type. Still air condensers are used on all units employing T-5 compressors and a high side float flow regulator is used.

Float Valve

Units employing the T-5 compressor use a high side float valve as a means of refrigerant control. The float valve assembly consists of a chamber surrounding a needle valve mechanism actuated by a float ball. When a sufficient amount of liquid refrigerant accumulates in the chamber, the ball is raised and in turn lifts the needle, thus opening the valve and permitting the refrigerant to flow into the evaporator. The float valve is all welded and brazed together. No internal service can be done in the field on this assembly. The heat exchanger, which allows the liquid refrigerant to be cooled just before passing through the valve into the evaporator tube, is a part of the assembly located inside the float chamber. Cooling is accomplished by the cool vapors returning from the evaporator to the compressor.

Evaporator

The evaporator used on T-5 units is constructed of steel stampings, comprising an outer and an inner shell so stamped as to form a continuous tube when assembled and welded together and with a large expansion head at the upper left side connecting to the low side suction line and a small inlet chamber on the upper right side. The shelves for the ice trays are made of plate copper. The upper shelf is refrigerated in order to maintain uniform freezing time in all freezing tray positions. The evaporator is of "U" shaped construction.

The evaporator front panel or temperature control panel may be changed, but the evaporator cannot be taken off the unit by dealer's or distributor's service shops. Should replacements of the evaporator be required, the operation should be done only by the Crosley Radio Corporation factory or one of its service depots.

Condenser

Still air condensers of the finned type are used on all of the T-5 models. The condenser is made of a continuous tube, so constructed that the lower half or section folds under the evaporator for convenience in shipment or handling. When installed, the entire condenser is in a vertical position. It is held to the back of the cabinet by lugs, which provide proper spacing between it and the back of the cabinet. The wide spacing of the fins prevents the common trouble of excessive dirt collection and the large size of the condenser provides ample cooling surface.

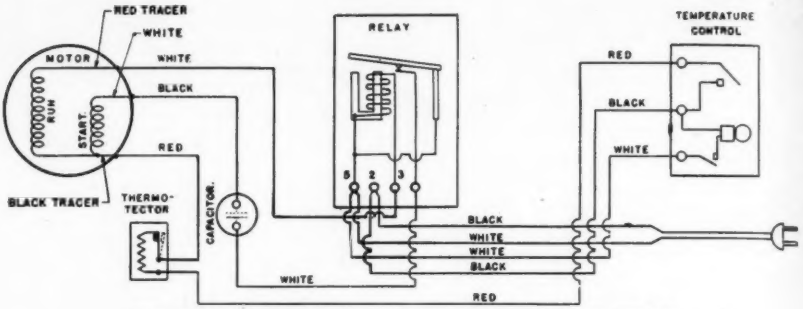


FIG. 2—T-5 WIRING DIAGRAM FOR G.E. MOTOR AND RELAY

Starting Relay and Circuits

Some T-5 units are equipped with a Delco hot wire start and overload relay. The two sets of contacts are controlled by a resistance wire elongating and contracting in proportion to the current passing through it. When the unit starts both contacts are closed. The combined currents of the starting and running windings of the motor pass through the resistance wire. This current is sufficient to elongate the wire enough to permit the starting winding contact to open after the motor is up to speed. Then the current drawn by the running winding under normal operating conditions is just sufficient to maintain the starting contacts in the open position. If for some reason the unit is subjected to excessive overloads, the current will increase sufficiently to heat the wire to the extent that it will elongate still more and allow the running winding contacts to open and the motor to stop. The relay will cycle "on" again and the unit will continue to operate provided the cause of excessive overload has been removed, but if the source of the overload remains, the relay will cycle on and off. The current which the relay will pass under the stalled condition is not sufficient to cause any damage to the motor.

Warranty service on Delco relays is available through United Motors Service, Inc.

Other T-5 units are equipped with G. E. motors and solenoid-type relays.

These units can be identified by the compressor serial plate, which is black for 50-60 cycle units and green for 25 cycle units.

All returns of G. E. relays or other parts for warranty adjustment must be made to the Crosley factory.

Temperature Control

The temperature control is a thermostatically-operated switch. A bulb containing a gas is connected to the control by a short tube. This bulb is located on the bottom of the evaporator where it is quickly affected by temperature changes in the cabinet and evaporator. As the temperature rises, the gas expands, and as the temperature lowers it contracts, operating the switch. By means of the control knob

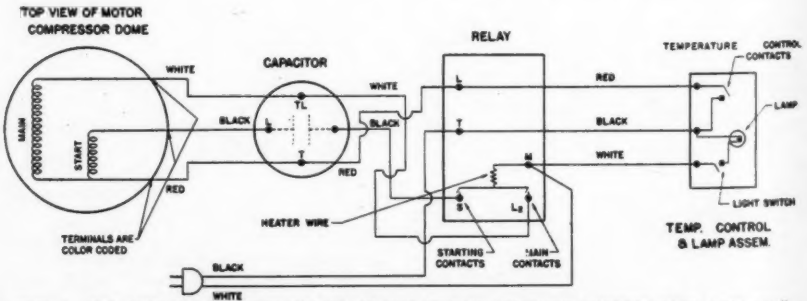


FIG. 3—T-5 AND T-1 WIRING DIAGRAM FOR DELCO MOTORS EXCEPT "30" AND "31" MODELS

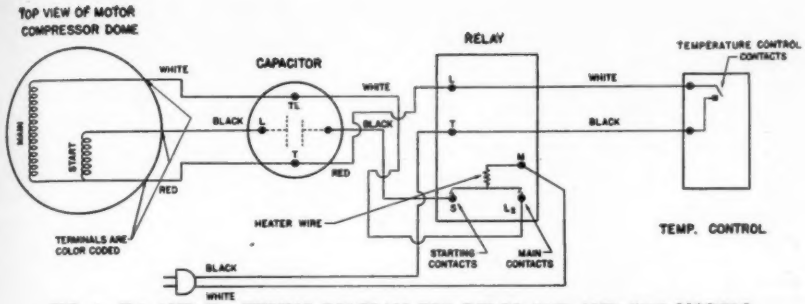


FIG. 4—T-5 AND T-1 WIRING DIAGRAM FOR DELCO "30" AND "31" MODELS

on the front panel, the temperature control switch may be set to operate the unit at various temperatures.

Capacitor

The capacitor, which is connected in series with the starting winding of the motor, provides greater electrical phase displacement, thereby creating a high starting torque.

The capacitor is located between the compressor and the condenser, adjacent to the high side float valve. It is connected electrically through cables to the motor terminals on the compressor, and to the relay.

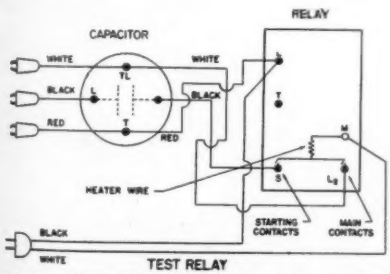


FIG. 5—TEST RELAY FOR G.E. AND DELCO

Dryer

All T-5 units are equipped with a dryer containing activated alumina. This is located on the side of the high side float chamber.

Measuring Head Pressure and Low Side Pressure

a. In order to measure high side pressures it will be necessary to attach the charging adapter assembly, which screws onto the threaded section on top of the high side float chamber. Remove the cover on the top of the chamber and attach the charging adapter assembly, tightening it until it seats firmly against the gasket. Make sure the packing gland nut is tight. Unscrew or open the purge valve. Operate the unit and read the head pressure. When the unit is operating with the evaporator temperature between 14 and 24 degrees F., the reading of the gauge should be approximately that given for the particular room temperature on the temperature-pressure chart.

b. In order to measure low side pressure it will be necessary to attach the charging adapter assembly, which screws onto the threaded section of the charging valve on the side of the dome. Remove the cover from the valve and attach the adapter assembly, tightening it until it seats firmly against the gasket. Operate the unit and observe the low side pressure. When the unit is operating with the evaporator cooled down to approximate normal temperature and the head pressure corresponds with the chart for that particular room temperature, the lowside pressure should agree within reason with the chart for low side pressure at the particular evaporator temperature which would be indicated on an indicating thermometer with its bulb attached to the evaporator at the temperature control bulb clamp.

Purging Air from the System

Should the unit air-lock it indicates air is present in the float chamber.

To correct this condition purging is necessary. To do this, stop the unit, allowing it to stand idle for five or ten minutes, and then purge a slight amount of gas from the purge valve. Should the unit again air-lock, repeat as per above directions. Only a small portion of gas should be purged at any one time.

Charging T-5 Units

In the field it may be occasionally necessary to add refrigerant to a unit. Use the following method for preparing the unit for charging:

a. Shut unit off.

b. Remove the cover from the charging valve on the side of the dome.

c. Screw on the charging adapter fitting, leaving it slightly loose for purging purposes.

d. Connect the refrigerant drum to the charging adapter by means of a short piece of tubing and tighten all flare joints.

e. Open drum valve slightly in order to drive out the air which is in the connecting tubing and charging adapter. The charging adapter may then be screwed down against the gasket.

Caution should be taken to never open the charging valve to open air because, even through the low side pressure with Freon-12 is ordinarily a positive pressure, under some conditions such as gas or air-locked float valve there will be a high vacuum in the low side and air would be drawn into the system.

The correctly charged unit shows frost on the suction line from the evaporator all the way up to the insulation block. If frost appears on the suction line above the insulation block it is an indication of overcharge. An extremely overcharged unit may not even frost on the evaporator, and in this case the compressor dome will be cold just below the suction line entrance. In case of an overcharged unit the excess refrigerant must be purged out through the purging port on the float valve chamber. If the evaporator does not frost over completely, including the suction line, it indicates it is still undercharged and refrigerant must be added.

Add refrigerant by the following procedure:

a. After preparing unit for charging as described above, open the charging port by turning the plug counter-clockwise. The key should then be pulled out of the plug socket approximately ¼ inch and the packing gland nut tightened.

b. Open the drum valve and allow refrigerant gas (not liquid) to enter the compressor dome with the unit operating. This is done by holding the refrigerant drum in an upright position. When the drum is inverted liquid refrigerant will flow. The low side pressure will be sufficiently lower than the pressure in the refrigerant drum to allow refrigerant to be drawn into the system without applying heat to the drum. Do not allow the drum valve to remain open for a great length of time as the unit will become overcharged. Just open the valve at intervals and check the frost line between operations. When the proper charge is indicated close the charging port and drum valve and disconnect charging adapter.

It is well to let a unit operate for several hours in a test bench cycling on normal temperature control position before the final check is given on charge. This will give the unit time to normalize under actual operating conditions.

Float Valve Trouble and Its Analysis

The needle of the float valve is a hardened chrome-stainless steel needle and the valve seat is stainless steel. This feature, combined with the fact that Freon-12 is a non-corrosive refrigerant, make a sticking valve needle or a leaky valve seat very unlikely to occur. If the valve needle sticks it can stick either open or closed. Also, the linkage between the float ball and the valve needle is very unlikely to disconnect; if it disconnects the valve needle would remain closed.

So, should the linkage disconnect or the valve needle stick or the valve seat leak, there would result either a complete stoppage of liquid refrigerant flow from the float to the evaporator or a continual refrigerant flow.

When the liquid refrigerant flow from the float to the evaporator is completely shut off by a closed valve needle, the compressor will run continuously and pump all the refrigerant from the evaporator into the high side. Thus the evaporator is pumped down and the compressor runs continuously with no refrigeration.

When the needle valve remains open, or the needle seat leaks there is a continual flow of refrigerant to the evaporator and the running time will be above normal if not continual. Usually the suction line will frost back to the compressor dome but if the valve is wide open the evaporator and suction line will only be cool. When there is only a slight leak through the needle valve the refrigerated shelf of the evaporator will defrost during the off part of the cycle and the suction line will frost above the insulation block during the first part of the running cycle but will gradually melt off as the unit continues to run. This condition should

not be confused with other conditions such as low charge causing the left side of the evaporator to defrost or not frost.

If the float ball should have a slight leak in it, it will in time fill with liquid refrigerant and loose its buoyancy and remain sunken. In this case the needle valve will remain closed. With this condition existing the unit will operate continuously with no refrigeration. This condition should not be confused with gas-locked float. The lift magnet may be used in this case to aid analyzing this condition. If the unit is properly charged and the lift magnet used while the unit is running, refrigerant will be allowed to pass momentarily and will be indicated by the cooling of the small tube from the float valve to the evaporator shelf. Should the float valve orifice be restricted and the unit properly charged when the magnetic lift is applied, there will be no cooling effect on the small tubing leading from the float valve to the evaporator shelf.

Caution: Do not allow the magnet to remain on the float chamber any longer than is absolutely necessary because the coil will heat the chamber and this is to be avoided.

Remember, a gas-lock is unlikely to occur under all conditions of normal operation because the heat exchanger incorporated in the float valve assembly maintains a lower temperature in the float chamber than the temperature of the condenser. However, some abnormality such as a low refrigerant charge or the heating of the float chamber with the magnetic coil will cause the float valve to gas-lock and then the float chamber must be cooled before the gas-lock can be permanently broken with the magnetic lift.

System Gas Locked

It is impossible for the 1938 unit to gas lock unless the unit is several ounces short of refrigerant.

If the float valve is gas-locked, you will get no refrigeration whatever and the evaporator will not frost up. To remedy this condition, use one of the following procedures:

1. Heat the condenser slightly with a torch following the tubing from top to bottom taking care to not burn or discolor the finish.

2. Ice or ice cold cloths may be applied to the float valve assembly. This causes a drop in pressure and allows the liquid refrigerant to flow into the valve chamber.

3. This third method may be used where other means are not available.—The compressor should be bolted down to keep it from shifting. The unit can then be removed from the cabinet and should be held by two men so that the condenser will be in a plane parallel to the floor with the compressor below the condenser. In this position, the end of the condenser farthest away from the float should be alternately raised for a few seconds approximately one foot above the other end of the condenser and lowered for several seconds to a distance of one foot below the bracket of the condenser.

The purpose of this rocking is to cause any liquid, which might be in the condenser to seek its level in the ¼ inch "condenser to float" tube, and then by raising the bottom end of the condenser, allow the liquid to run through the ¼ inch tube into the float.

At the same time the float ball falls back and causes the valve needle to open, allowing the liquid, which has been in the ¼ inch tube to pass over into the evaporator. This procedure is carried out ten or twelve times. In this manner all the liquid in the condenser can be drained through the float into the evaporator.

After the unfastened end of the condenser is lowered to fill the ¼ inch tube and has been rocked so that it is higher than the rest of the condenser, the drainage through the unit can be ascertained by a distinct hissing sound as the liquid expands into the evaporator past the seat in the float.

Following out one of the above procedures will break the gas or vapor-lock and the unit will refrigerate properly if it has sufficient refrigerant.

Air in System

If air should be permitted to get into the unit during servicing operations it will collect in the float valve chamber and cause the float valve to air-lock. In this case there would be no refrigeration with continuous running of the compressor. One should first be positive that it is not a gas locked condition before purging air from the purge port on the float valve chamber. If an air-locked condition exists it may be temporarily broken by heating the condenser with a torch but will re-occur after operating a few minutes. Only after it is positively determined that an air-locked condition exists should any purging be done.

A unit which fails to refrigerate due to

moisture freezing at the float valve orifice will refrigerate again if the unit is shut off long enough to melt the ice at the float valve. It may be definitely ascertained that moisture is causing a refrigeration failure by operating the unit in a test bench or cabinet. At the time the evaporator starts to defrost the float valve orifice may be heated with a small torch where the small tube comes through the insulation block from the float valve sufficiently to melt the ice. This will allow the refrigerant to flow again into the evaporator. If the evaporator fails to frost again then the unit is probably gas-locked or has some other trouble.

TO BE CONTINUED

The August issue will contain additional data on the T-5 unit and complete service information on the T-1 unit.

Frozen Food Lockers in Oregon

By LeROY WILLIAMSON

What type of equipment is most suitable for certain installations? The author of this article is of the opinion that in his particular territory ammonia equipment is best adapted to locker storage work. We present his views.—Editor.

AN obliging ice plant operator in a little Washington town, tired of stumbling over the fruit, fish and game with which his friends were cluttering up his ice storage room, nailed a few packing boxes on the walls, made rough screened doors for them and began charging rent for the boxes. If his thought was to discourage an objectionable practice begun as an accommodation he was to be disappointed. The temperature of this first locker room was only a few degrees below freezing, the boxes were crude and the customers sometimes had trouble keeping their footing on the icy floor, but the idea was sound and soon he was forced to put up more boxes to take care of the increasing demand.

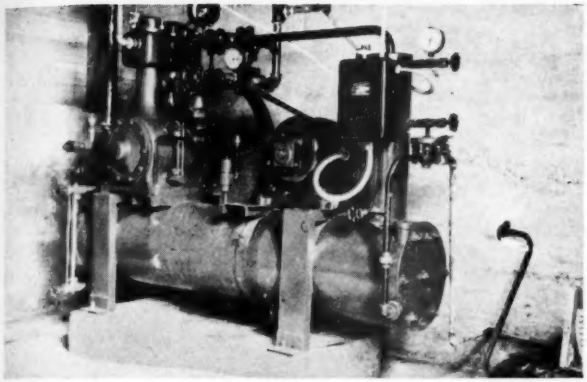
From this humble beginning, and much to the astonishment of the originator of the idea, sprang a brand new business which grew with surprising rapidity. This lusty offspring of the cold storage industry has added some 2500 new plants in the United States, 8,000,000 cubic feet of freezer storage and over 10,000 horsepower of refrigeration equipment to the existing plants since its inception about twelve years ago.

By far the greatest concentration of these frozen food lockers in comparison to population is in the Pacific Northwest which gave birth to the first plant of this kind. Washington, with a population of 1,600,000 has 125 plants, while Oregon has 92 plants on record serving 1,250,000 people.

As this business depends primarily on rural support, locker plants are logically located in centers of rural trade and usually in combination with meat markets, creameries, feed and seed stores and cold storage plants. A few of them are located in crossroad village stores, but most of them will be found in the larger towns while shunning the strictly metropolitan areas. For example, Portland, largest city in the state with a population of 300,000, has no lockers at present. Salem, with a population of 26,000 and center of a rich farming community, has 3 plants with 2100 lockers. Klamath Falls, in the southern part of the state, population 18,000 people, has 5 plants with 1900 lockers.

There seems to be no standard of locker capacities here. There are a few plants with lockers as small as 5 cubic feet, but 8 and 10 cubic feet are the preferred sizes, with a few in each plant of double this capacity. This being a lumber country, wood construction is favored both in the building of the individual lockers and in the building proper. Frame construction and filled insulation also find favor here.

As with all low temperature rooms, insulation of locker rooms is of first importance. Sheet cork is, of course, the old stand-by, but many cheaper substitutes have been used successfully here. One of Portland's large woodworking plants has developed a special cut, kiln dried sawdust for insulation purposes and it has been used extensively. This sawdust, called "Flakewood" weighs about 11 pounds per cubic foot and has a conductance factor of .36 B.t.u. per inch thickness per square foot per degree temperature difference. A thickness of 12 inches is recommended for zero temperatures. Redwood

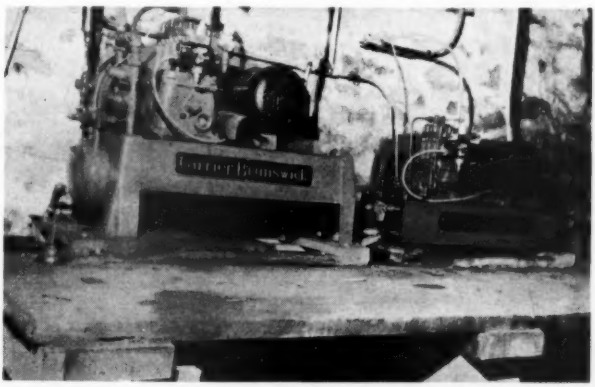


A 3-h.p. Ammonia machine installed at the Gaston Meat Co. in Gaston, Oregon.

bark has been used in a number of locker rooms with good results. The manufacturers of this product recommend a thickness of 10-12 inches for zero temperatures. Celotex, Firtex (a fir fiber product similar to Celotex) planer shavings and ground cork have all been used with more or less satisfaction. Insulation has to be bought only once and where this is of first quality there is a continual saving in the cost of the current used by the refrigeration machine. Inferior insulation requires a larger ice machine or longer running time with attendant high operating costs.

For a well insulated locker storage of 250 lockers about 3 horsepower of machine capacity is installed. Of the installations in Oregon, ammonia machines lead the field. The number of low pressure locker installations probably does not exceed half a dozen in the entire state. Comparatively speaking, the low pressure installations are of greater horsepower for the same space than the ammonia jobs. For example, Shaw's Market at Molalla, Oregon, has a 3 horsepower Freon-12 unit holding a five degree temperature for 224 lockers with a cold diffuser. The fan on this cooling unit is one horsepower, running continuously. The chill room, at 34 degrees, and a 10 foot retail meat case, are refrigerated by an additional one horsepower machine, making a total of five horsepower. A few miles away the Gaston Meat Company maintains the same temperature for 214 lockers, a chill room and a small ice making tank with a three horsepower ammonia machine.

While cold diffusers or unit coolers are frequently used on the low pressure jobs, iron pipe coils are used on all the ammonia installations with the exception of four or five which have brine spray units. For the chill rooms, usually held at 32 to 34 degrees, ammonia unit coolers have been used with



The Carrier Refrigerating machine installed at Trullinger and Eustice, Yamhill, Oregon.

great success. Pipe coils are of two main classifications; namely, those coils built with horizontal headers and those having a continuous run of pipe in a bank or bunker coil. Where headroom is limited header coils two pipes high and covering the entire ceiling space over lockers and aisles are used, while bunkers of five or six pipes wide and three or four pipes high hung over the aisles are preferred where the necessary height is available. This latter arrangement allows greater accessibility for defrosting and the removal of the frost and ice from the room. No drip pans are placed below the coils.

In large locker rooms having from two to

View of locker rooms showing wooden lockers.

six bunkers, each coil may be fed by a separate thermal valve or all the coils may be connected to top and bottom headers and fed by a single thermal valve. In some of the earlier installations a constant pressure expansion valve was used to feed the coils, but better results have been obtained by using a thermal valve with a low pressure switch to actuate the motor starting switch, and all the ammonia coil installations now use this method of feed and control. By using a large accumulator header on his coils, one Oregon manufacturer uses only a hand expansion valve to feed some of his locker room jobs. Unless the ammonia charge is excessive the adjustment of such a valve is not sensitive as practically all the liquid ammonia is always in the coils.

Perhaps without exception on ammonia jobs the chill room at 32 to 34 degrees and the locker room at 5 to 10 degrees are refrigerated by a common compressor. In the chill room a thermal valve is used to feed the coil or unit cooler with a magnetic suction stop valve operated by a low pressure switch to control the temperature. In some cases a check valve is placed in the suction line from the locker room to prevent a flow of refrigerant from the warmer coil to the colder coil, but this is by no means a universal practice.

In any kind of locker storage using any refrigerant a constant problem is the removal of frost from the coils. Where a brine spray unit is used the problem resolves itself into a gradual weakening of the brine and its attendant demand for the addition of more salt to keep the solution at the proper density. Where a unit cooler with finned coils is used the coil must be defrosted at intervals of from two to three days. If the unit cooler can be located against a wall separating the lockers from a warmer room, defrosting is comparatively simple as in Shaw's Market at Molalla. When it is necessary to defrost, which is usually twice a week, a damper in the cold air duct above the fan and a metal door on the air intake are closed. Two refrigerator doors on the outside wall back of the unit are then opened and with the fan in operation warm air is drawn through the coil, the frost melts and the water is carried off through a drain to the outside. The whole operation takes about five minutes. Trullinger and Eustice at Yamhill, Oregon, who also have a Freon-12 plant totaling 5½ horsepower, use a novel method of removing the frost which accumulates so rapidly on the fins of their cold diffuser. In this case the fan is shut off and the dampers closed. Then a stream of cold water is played over the coils, the water running out a drain in the bottom of the pan. About 15 minutes are required for this operation and it is usually done every other day.

With ammonia machines using iron pipe coils, frost accumulating on the coils reduces efficiency very slowly so that it is seldom necessary to defrost oftener than twice a year. This is best done by hot gas from the compressor, but in order to use this

method successfully the coils and piping must be designed with this end in view. With a single coil or even with a series of coils not properly valved off, defrosting by "reversing" the machine will usually result in failure. Where the locker room coils are connected to a machine operating on other coils or where the locker room coils themselves are divided and suitably valved, the hot gas system works very well and the six months' accumulation of frost and ice may be removed in a reasonable length of time. The Mt. Angel Co-operative Creamery at Mt. Angel, Oregon, has a room containing 424 lockers with header type coils divided into three sections. When defrosting, canvas is spread over the tops of the lockers to prevent ice and snow from entering. About 20 minutes after turning on the hot gas, the frost has begun to sag on the pipes and a few well directed raps on the coils will bring down the frozen mass so that it can be carried from the room. This procedure is typical of defrosting in ammonia plants.

Power Consumption

Power rates are quite reasonable in most sections of this state and the cost of power for operating a storage of 250 lockers will probably average $20.00 a month over a period of a year. Where power costs are available it is shown that the ammonia jobs are operating for a little less than the low pressure installations. At Shaw's Market, with a total of five horsepower connected to two Freon-12 compressors and two cold diffusers, the average monthly cost of refrigerating the 224 locker storage, the chill room and the 10 foot display case is $30.00 per month. The Trullinger and Eustice installation at Yamhill, refrigerating 300 lockers, has an average consumption of 1312 kilowatt hours at a cost of $31.45 per month. Jordan Farm Service, which operated 200 lockers at Stayton last year (doubling this space this year), with a three horsepower ammonia machine, had an average monthly consumption of 878 kilowatt hours per month last year at a cost of $19.86 per month. In the eastern part of the state where summer temperatures are considerably higher than in the Willamette Valley where the first mentioned plants are situated, May and Son at Moro have 112 lockers, a chill room and a retail meat case on a three horsepower ammonia machine. In September, 1937, they used 1005 kilowatt hours costing $18.30. At Condon, Oregon, William Colby, with a three horsepower machine and evaporative condenser refrigerated 200 lockers in September, 1937, for $15.64, using 574 kilowatt hours. The water cost for these ammonia machines will average $7.00 per month and where higher than this, may be reduced by using a cooling tower or evaporative condenser. This water cost is about the same as for the low pressure machines of like capacity where information on this is obtainable. Trullinger and Eustice are fortunate in having a very low flat rate, while Shaw's Market paid an average of $8.00 per month for water in 1937.

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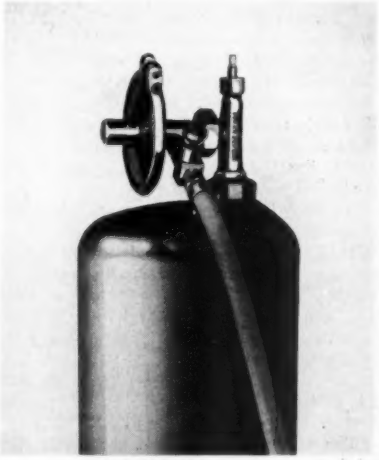
CORRECTION

AN article on page 27 of our June issue, headed "Service Tip," suggested that an old automatic expansion valve made a good regulator for a Prest-O-Lite gas tank. It has been brought to our attention that



there are hazards involved in the use with acetylene of any device or appliance not specifically designed for that purpose. Suitable regulators are available on the market for Prest-O-Lite gas tanks. One of them, the Prest-O-Lite A-6053 10-lb. regulator, is shown here.

S S S

Busse & Thiel Co.
Wisconsin

We get THE REFRIGERATION SERVICE ENGINEER every month, and are well pleased with the articles in it.

Twelfth Article

Air Conditioning

The General Electric 1934 Model CM5W Refrigerating Machine for Use with Air Conditioning Units

by W. C. FARMINGDALE

THE General Electric 1934 Model CM5W refrigerating machine has been used by several manufacturers of air conditioning equipment. The units were well built and do an excellent job of cooling. These jobs are old enough now to require service; hence, it might be well to devote an article in this air conditioning series to this particular model of refrigerating machine.

The CM5W is a one horsepower vertical, water cooled refrigerating machine that has its compressor body mounted over its motor. The counterflow condenser, in turn, fits over the compressor body and the high-low pressure switch is located between the inside bends of the counterflow condenser and the compressor body. This type of construction makes the CM5W a very compact unit. Because of this compact arrangement of parts, the CM5W was used in many self-contained room conditioners.

A heavy sheet metal, sound insulated cover goes over the working parts of the CM5W which makes the unit a neat looking package. Both liquid and suction valves are located inside the unit. This means that all lines (liquid, suction and water), terminate in plugs on the right side of the sound insulated cover.

The CM5W was supplied with either a 220-volt a.c. or a 230-volt d.c. one horsepower motor.

The a.c. motor supplied was a special type of single phase capacitor-start-capacitor-run motor. In order to operate, the motor had to be equipped with a starting relay and two large capacitors. This starting relay and associated capacitors were located to the right of the motor under the counterflow condenser.

When a direct current motor was supplied, it was equipped with a special single pole direct current magnetic contactor which started and stopped the refrigerating machine motor as the contacts in the low pressure switch opened and closed. This magnetic contactor was located under the counterflow condenser to the right of the motor in the same place as the relay and capacitors of the a.c. motor described above.

Because both the a.c. and the d.c. models of the CM5W had built-in starting relays, an external across the line starter was not required. However, since neither of these relays employed a motor overload protector, it was customary to use a line switch which did incorporate an overload protector. This switch and the a.c. and d.c. motors and relays will be described in detail later in this article.

The CM5W Compressor

The CM5W compressor body was designed for use with Freon. Freon gas entered the crankcase of the body through the suction valve and passed up through the piston valves, through the water cooled discharge valve plate into the compressor head. Because this path of flow brought the Freon gas into intimate contact with the oil in the crankcase of the machine, the 1934 model CM5W will scrub oil badly if it is not operated properly, especially if the operation of the refrigerating machine is controlled by a low pressure switch. If the cut-out point on the low pressure switch is set too low, the compressor will scrub oil every time the machine stops. In order to prevent this, the low pressure switch should be set to cut out at a pressure about 5 pounds lower than that at which the cooling coil and compressor balance out. For instance, if when the air conditioning system is working at rated conditions the normal operating back pressure is 30 pounds, the low pressure switch should be set to cut out at about 25 pounds and the cut-in pressure should be at least 15 pounds above this or at least 40 pounds. If the differential between the cut-in pressure and the cut-out pressure is closer than 15 pounds there is danger of the refrigerating machine short-cycling.

The original 1934 model CM5W compressor was equipped with a two-belt drive. However, it was found that this gave in-

sufficient belt driving surface for use at air conditioning back pressures and as a result the two-belt drive was changed to a five-belt drive. Occasionally a CM5W will be found with a two-belt drive. If trouble has been experienced with burning belts, the two-belt drive should be changed to a five-belt drive in order to insure long belt life and complete customer satisfaction. Burning belts are far more serious on air conditioning installations than on commercial refrigeration installations because in air conditioning work, the compressor is generally in the conditioned space so that the smell of burning belts is sure to get into the conditioned air and create a disagreeable odor that will cling to the room for a long period of time.

When changing from a two-belt to a five-belt drive, both the flywheel and the pulley must be changed. Because the flywheel is a solid casting, few flywheel pulleys can be used to remove it. Luckily, however, the flywheel is not driven tightly onto the crankshaft so that by wedging various size wrenches between the flywheel and the seal plate cover, the flywheel can be walked off the shaft with little difficulty. In the wedging operation, care must be taken to maintain an equal force on either side of the flywheel to prevent springing the shaft and thus causing a seal leak and a wobbling flywheel.

The Discharge Valves

The discharge valve plate is merely a perfectly smooth flat plate with two holes bored through it for the passage of refrigerant gas. There are no individually ground valve seats as are used on some other makes of valves. Hence, in order to repair the valve seats it is necessary to lap the entire upper side of the valve plate. This can be done by using a large lapping block and fine lapping compound.

The discharge valves are flat pieces of Swedish steel which are held in place by two heavy pieces of spring steel.

Very little trouble with leaking discharge valves has been experienced on the 1934 Model CM5W. Perhaps one reason for this is that the Freon gas in passing over the oil in the crankcase, picks up with oil vapors which are carried up around the discharge valve plate and thus maintain an oil seal between the discharge valve reeds and the discharge valve plate. In those cases where trouble has been experienced with leaking discharge valves, the trouble has been overcome by lapping the valve plate and replacing the valve reeds.

When the discharge valves are repaired, a stiff wire brush should be run through the two water holes in the discharge valve plate and the holes should be flushed out with clean water. In case any water should get on the discharge valve proper, the entire valve should be washed in carbon-tetrachloride, and dried off with an air gun. Then if the valve isn't to be used immediately, the valve seats and reeds should be smeared with refrigerator oil to prevent moisture in the air from rusting them.

The Use of Alcohol in Freon Machines

In 1934, when this model CM5W was used, little was known about the properties of Freon refrigerant. At that time engineers thought that they did not have to worry about moisture in Freon systems. As a result, many engineers and service managers recommended that if a Freon system was found to contain traces of moisture, about a teaspoonful of anhydrous methyl alcohol should be added to the system to lower the freezing point of moisture and hence prevent the moisture from collecting and freezing at the expansion valve.

However, since that time it has been found that moisture and alcohol along with refrigeration oil in a Freon system tend to set up a condition which fosters copper plating. This chemical condition tends to remove copper from refrigerant lines and to deposit this copper on all-steel surfaces such as on cylinders and cylinder walls, crankshaft bearing surfaces and on the walls of crankcases. In extreme conditions, this copper plating will put such a heavy coating of copper on cylinder walls and on pistons that the pistons stick in the cylinders and as a result the compressor won't turn over.

The writer has seen evidence of copper plating in several CM5W's, although he has not seen a compressor stuck up as a result of this plating.

Hence, when evidence of moisture is found in a CM5W machine, a drier should be installed in the liquid line to remove the moisture rather than add alcohol to dilute the moisture. Leading manufacturers recommend that this practice be followed on all Freon or methyl chloride machines to prevent troubles due to copper plating and also troubles due to rusting.

Oil Level on Compressor

An oil level plug is located on the rear cover plate of the compressor. When there is zero pounds pressure in the crankcase, oil should come out of this hole.

The manufacturer recommends an oil charge of five and one-half pints. With this charge, oil will come out of the oil level plug hole. However, the writer has found that this amount of oil in the crankcase causes an excessive amount of oil slugging especially when operating at air conditioning temperatures. In practice he has found that about three and one-half pints of oil prevent excessive slugging and apparently provide adequate lubrication. (The oil level test hole as shown in Figure 1 is at the center of the crankcase. This means that with an oil charge of five and one-half pints, half of the throw of the crankshaft is flinging oil all the time that the machine is operating. On the other hand, with an oil charge of three and one-half pints, the oil level is only about half-way up the crankshaft so that the amount of oil thrown around the crankcase is lessened materially and yet the connecting rod bearings are still submerged in oil every time the piston goes down in the cylinder.)

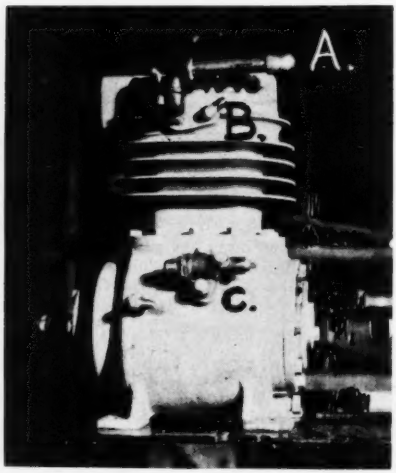


FIG 1.—G.E. COMPRESSOR.
A—Outlet Water Connection.
B—High Pressure Switch Connection.
C—Suction Valve.

Because of the large oil charge in CM5W machines, little trouble has been experienced due to noisy compressors. All parts are so thoroughly lubricated by the large amount of splash that piston pins and connecting rod bearings seldom wear sufficiently to cause noise. The only noise complaints that the writer has experienced have been those caused by oil slugging when the compressor pumps down. These noises can be eliminated either by resetting the cut-out point of the switch or by bleeding oil out of the compressor until the oil slugging stops in the pressure operating range of the compressor.

The Counterflow Condenser and Water Coil

The counterflow condenser used on the CM5W is of the conventional tube-within-a-tube type. However, because the CM5W is totally enclosed in a sound-proof cover, a water coil is silver soldered to the water circuit on the counterflow condenser and this water coil is mounted over the motor. The water coil is used to absorb heat from the motor and thus prevent the temperature of the enclosure from becoming great enough to burn out the motor. Water flows from the water valve into the water coil and then into the counterflow condenser to the head of the compressor. Because of this path, the water is coldest when it passes through the water coil so that the greatest possible temperature difference exists between the water coil and the enclosure temperature. As the water passes through the condenser it absorbs heat from the refrigerant gas and turns this gas into a liquid which flows by gravity into the liquid receiver.

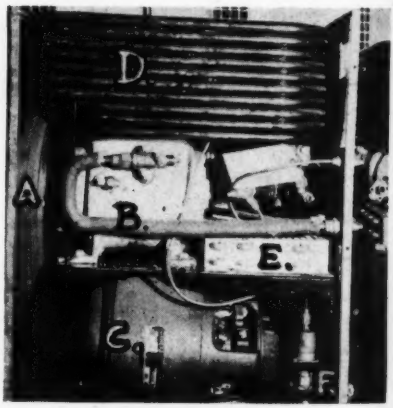


FIG. 2—THE G. E. UNIT.
A—Five Belt Drive.
B—Suction Line.
C—Motor.
D—Counter Flow Condenser.
E—Water Coil.
F—Water Valve.

Noisy Condensers

The counterflow condenser used on the CM5W seldom gives trouble as far as refrigerant leaks are concerned. However, from time to time the condenser does give off a disturbing loud noise. This noise is caused by the inside tube vibrating and striking the outer tube.

In a number of cases the writer has found that this noise was caused by a defective water valve. It was found that the water valve would open and close rapidly thus causing the water to surge inside the condenser and make the inside tube vibrate. In one particular instance it was found that the high pressure bellows of the water valve was filled with oil. When the bellows was replaced, the noise in the counterflow condenser subsided.

In some cases, the noise in the condenser is due entirely to normal vibration of the refrigerating machine. When this is found, the noises can generally be stopped by driving one or two small wooden wedges between two of the tubes of the condenser. In extreme cases, the noise can be stopped by taking a short length of 2 inch x 4 inch lumber, holding it against the side of the condenser and giving the 2x4 a smart blow with a hammer. This realigns the tubes inside the condenser and stops the noise. The 2x4 may have to be set in several places before the noise is stopped. This last procedure may seem dangerous but when you consider that all joints are silver soldered and that the 2x4 distributes the blow over all tubes there is little possibility of damaging the condenser. Of course the condenser should not be squashed at any point or else a restriction will occur.

The Water Valve Used on the CM5W

A Penn water valve is used on the CM5W. This water valve is shown in cross-section in Figure 3. This type of valve is used by many manufacturers and gives very little trouble in service. The two parts of the valve that may give trouble after several years of service are the composition valve seat "G," and the bellows "B."

The valve is so constructed that both of these parts can be changed readily. To change the bellows, first run the head valve all the way in and then disconnect the high pressure connection at the valve. After this has been done, the bellows can be changed by removing the four machine screws and lifting the bellows assembly off. When installing the new bellows, run the adjustment "O" in Figure 3 all the way down to relieve the compression on the internal spring in the bellows. Then after the bellows has been installed the valve will have to be reset.

The valve seat may be changed by unscrewing the nut "L" on the bottom of the

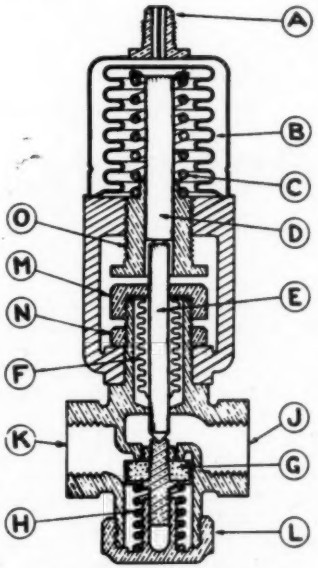


FIG. 3—WATER VALVE USED.

A—Pressure Connection.
B—Pressure Bellows.
C—Adjusting Spring.
D—Bellows Push Rod.
E—Packing Bellows Push Rod.
F—Packing Bellows.
G—Valve Seat.
H—Valve Seat Spring.
J—Inlet Connection.
K—Outlet Connection.
L—Removable Nut.
M—Packing Nut.
N—Locknut.
O—Adjusting Nut.
P—Strainer.
Q—Pump Connection.

valve. When this is removed the seat will fall out. Oftentimes the composition seat can be turned over in the valve seat guide and a new seat is not required. After the seat has been changed the valve should be tested to see that the adjustment hasn't been altered.

To adjust the water valve on the CM5W, install a head pressure gauge and allow the machine to operate for about 10 minutes. Then stop the machine and watch both the head pressure and the water drain line. When the head pressure reaches 90 pounds, the water should stop flowing. If the water continues to flow after the head pressure drops to 90 pounds, run the locknut ("O" in Figure 3) up until the water just stops

flowing. Then start the machine and recheck the valve setting.

With the water valve set to open at 90 pounds, the valve will be wide open when the head pressure exceeds 115 pounds. Hence, if a job is found operating with a head pressure higher than 115 pounds, and the water valve closes at 90 pounds, adjusting the water valve cannot bring the head pressure down, because at 115 pounds, the valve is wide open.

If the CM5W is operated in a community where water is relatively expensive, the water valve should be set to open at about 105 pounds. Then the water valve will not be fully open until the head pressure reaches about 130 pounds. In this way the machine will use less water than with the water valve set to open at 90 pounds. However, the service engineer should realize that because of the higher head pressure the capacity of the refrigerating machine will be slightly reduced while the electric consumption will be slightly increased.

Automatic Oil Separators

By F. B. RILEY *

FOR the past several years it has been obvious that oil passing through to the low side of a refrigerating installation has caused considerable difficulty in effecting its return to the crankcase. Vast sums have been spent in devising various ways of getting the oil to return, but with little thought being given to preventing it from passing to the low side. It is not the purpose of this brief discussion to go into details of oil separating mechanisms, but merely to state that efficient oil separators are now available which separate out all of the oil from the atomized oil and refrigerant mixture as it leaves the compressor head and return it to the crankcase before the gas can reach the condenser.

The modern low pressure refrigerants were primarily used in domestic cabinet installations where, with the dry gas expansion, there was comparatively little trouble experienced with the oil which passed to the evaporating coils. At the same time, two types of flooded systems came into use; namely, one with a high side float using methyl chloride, and a brine tank evaporator with an accumulator located inside of the tank, which not only performed its function as a spill-over for the refrigerant, but also acted as a trap for oil where it remained permanently; and, second, the low side float with sulphur dioxide as the refrigerating medium. It became a problem to regulate the blanket of oil on top of the sulphur and to secure its proper return to the crankcase. Next in point of volume production came the modern ice cream cabinets, and these were usually operated on the low side float principle with sulphur dioxide.

Now came the small commercial machines, water coolers, bottle and beverage coolers, small commercial installations and, finally, the larger multiple commercial installations and air conditioning equipment, with practically all of these latter devices operating on methyl chloride or Freon, both of which are miscible in all proportions with the commonly used lubricating oils. It was with these later types of units that the great need of an oil separator began to be felt as the lubricants had a great tendency to remain in the evaporators with a resulting trouble in the crankcase due to lack of sufficient lubrication; and it was also evident that, because of the oil film on the evaporators, the capacity was materially reduced and, in low temperature work, it frequently became impossible to attain the required low temperatures even with excessive operating time. Every service engineer who has handled the flooded types of evaporators in the multiple apartment installations and some types of commercial installations know the troubles caused by "oil logging" of evaporators and the frequent necessity for removing the evaporator completely and purging it of its oil accumulation.

A refrigerant gas naturally follows the line of least resistance and, in spite of the control valves now used in multiple installations, it is frequently difficult to secure the desired temperatures in the various units for the reason that gas velocity is a considerable factor in figuring the return of

* President, Riley Engineering Corp., manufacturers of Riley "Oilrite" Automatic Separators.

lubricants from the low pressure side. Slow moving gases drop the oil quite readily and especially on the cold surfaces of the evaporator where it clings indefinitely. The real problem is in securing a return of oil from the evaporator center chiefly in the multiple installations, low temperature installations, flooded types of evaporators and those in which the gas velocity is quite low. carried along by the oil in the refrigerant mixture and this almost invariably deposits in the metering valves, causing regulating troubles and possible final stoppage of the valve itself; fourth, the varying quantity of oil mixed with the refrigerant makes close regulation of the valve impossible as part of the orifice is taken up by the oil instead of the refrigerant. With pure re-

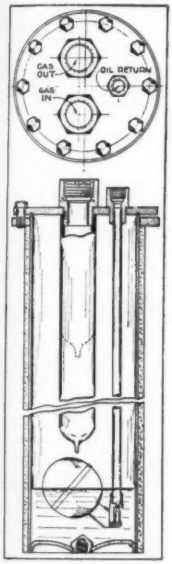


Fig. 1

Adapter Block

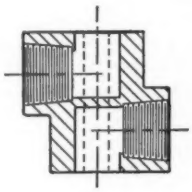


Fig. 2

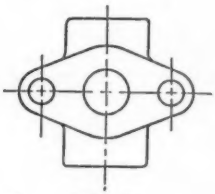


Fig. 3

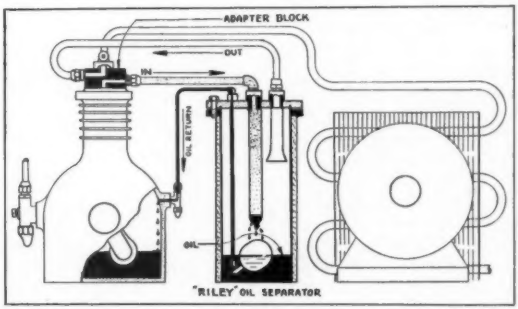


Fig. 4

Fig. 1 shows a cross section view of separators Nos. 100 to 105. Figs. 2 and 3 show the adapter block used to install the separator on existing systems. The block is installed between the compressor head and discharge shut off valve thus making it unnecessary to discharge the condenser when installing the separator. Fig. 4 shows a typical application using the adapter block.

To enumerate briefly the disadvantages of permitting the oil to pass into the low side where it, of course, serves no useful purpose: First, the mixture of oil and refrigerant, depending upon the amount of dilution, prevents the evaporation of the refrigerant at its true boiling point, necessitating a lower back pressure to attain desired temperature, and this fact decreases the compressor capacity; second, oil depositing on the walls of the evaporator serves as an efficient insulator and prevents the normal transfer of heat through the walls, again reducing the evaporator efficiency as much as 15 percent to 20 percent; third, the foreign matter in a system, such as dirt, lathe chips, core sand, carbon, etc., is usually

frigerant passing through, it is found that very much closer regulation is secured without fluctuation; fifth, with flooded type evaporators, and especially in air conditioning installations, with coils entering a common manifold or suction line, it is found that some of the coils will accumulate considerable quantities of oil, chiefly because of a slower gas velocity through some of the coils than through others; sixth, in low temperature work the oil will naturally gather faster on the walls of evaporators of lower temperatures and this film of insulation continues to build up, retarding very seriously the heat transfer through the walls.

Now, to come to the benefits of installing

an automatic oil separator: First, a constant level of lubricant is in the crankcase all the time; second, by separating out the oil, the refrigerants can now evaporate at their true boiling point; third, oil-free evaporators permit the highest possible heat transfer with greatly increased efficiency; fourth, in low temperature work, an oil-free evaporator gains very markedly because the refrigerant remains at its true boiling point, in addition to the fact that the coils are free from the insulating film of oil; fifth, expansion valves are aided greatly by keeping foreign matter, such as scale, oxides, core sand, etc., in the oil separator where it can not get out to cause trouble with the metering valves; sixth, "oil logged" evaporators, on either direct expansion or flooded types, are eliminated.

Why They Are Not Standard Equipment

All of these gains are unquestioned, and practically every commercial installation will be improved by installing an efficient oil separator between the compressor and the condenser. Assuming all of these advantages to be correct, why is it that the unit manufacturers have not added an automatic oil separator to their high side assembly? The obvious reason is that no unit manufacturer will add one penny to the cost of his compressor assembly unless his competitor absorbs a similar cost. Prices are very competitive and the addition of a few dollars to a high side is increased several times as this additional cost is stepped up to a selling price to the user, and this increase frequently means the loss of a sale to the manufacturer or the distributor. It is safe to say that, within one or two years at the outside, every unit manufacturer will furnish this obviously necessary device rather than suggest that the field add the separator to the unit when, or after, it arrives at destination. In the meantime, there is a tremendous opportunity for installing an efficient oil separator in practically every commercial system, now in service, thus bringing older units up to their highest efficiency.

The ammonia machine manufacturers are making quite a point of the fact that, in low temperature installations such as the refrigerated lockers, the ammonia machines are the only ones that are equipped with an oil separator that keeps the evaporator free from the oil films which are bound to gather on the evaporators of all low temperature installations. A user of any commercial machine will benefit greatly by equipping with an efficient automatic oil separator, but the need in the low temperature work is particularly stressed as from five to eight degrees lower temperature is easily obtained in the same operating time when oil is kept out of the evaporator where it serves only to insulate the walls with a blanket of oil, thus cutting down the rapidity of heat transfers.

HOW COLD SHOULD DRINKING WATER BE?

WINE at room temperature, beer at 42 degrees—at what temperature should the slightly less exciting but much more important water be served? It all depends on what you are doing, according to A. H. Reinach of Nash-Kelvinator Corporation.

The more work you do, Mr. Reinach declares, the more water you need—and, up to a certain point, the warmer the water should be. Water below 45 degrees may seriously endanger health, causing cramps, chills, and digestive disorders. On the other hand, water above 55 degrees is neither refreshing nor appetizing. Neither tap water nor ice water generally come within this "safe" range.

Mr. Reinach, who heads the Liquid Cooling Department for the Kelvinator Division of the Detroit Corporation, has directed installation of many thousands of water coolers in factories, restaurants, hotels, theaters, and stores. His experience, together with medical requirements, have been incorporated into the Kelvinator water usage table, which is being used as a guide to factory manager, restaurant stewards, and office managers in choosing electric water cooling units.

Doctors have prescribed a minimum of six to eight glasses of water each day as an absolute minimum for preservation of health. Factory workers, athletes, and others engaging in strenuous work will require nearly four times as much, or almost 200 ounces; office workers can get along with approximately 50 ounces a day, or little more than six glasses.

Temperature of water should vary from 45 degrees, to be served with dinner; to 55 degrees, to be served while working or engaging in golf, tennis, or other physical activity. Water for schools should be furnished at a temperature between 50 and 55 degrees, for hotels at a temperature of 50 degrees, and for restaurants and cafeterias at a temperature from 45 to 50 degrees.

Cotter Pin Extractor *and* Speed Reamer

By L. K. WRIGHT, M.E.

SMALL cotter pins, such as found on pressure and temperature controls and in many other parts of household equipment, are rather difficult to straighten out and remove by the conventional method which involves the use of long or needle nose pliers.

If the worker runs into a lot of this work, such as on overhaul jobs, it will pay him to make up the extractor shown in the upper part of Fig. I.

It will be necessary to obtain a piece of steel ¼ inch in diameter. The writer used a piece of the outside frame from around a refrigerator wire shelf, first, because it was of proper size and, secondly, was galvanized.

The end of this piece of round steel was filed down and then bent over to form the hook, shown in Figs. I and II. The inside part of the hook was slightly flattened to eliminate slippage when using.

A piece of steel was cut and drilled to take the rod. There are two simple ways this stop block can be secured to the rod. One is to drill both rod and block after assembly and pin the rod in place, or the rod can be threaded and screwed into a tapped hole in the block, as shown in the sketch. Again, the rod could be brazed in place. The builder can use whatever arrangement is suited to his shop equipment.

The knocker or slider part can be made of a piece of brass or iron rod, of one inch diameter. Drill this as indicated so it will slide freely on the rod when assembled.

Assemble as shown in the illustration (Fig. I), making sure knocker is in place before brazing or pinning the rod. A threaded job can be taken apart, but the former are difficult to pull apart, so take care to have the knocker on the rod if brazing or pinning is resorted to.

To use this tool, first open up the cotter with pliers. Then put the hook of the extractor in the eye of the cotter and, using the knocker, strike it against the stop block, thus extracting or pulling the pin.

If desired, this tool can be made shorter for close work, but less than four inches of rod is not recommended. The longer the stroke, the easier it is to extract the cotter.

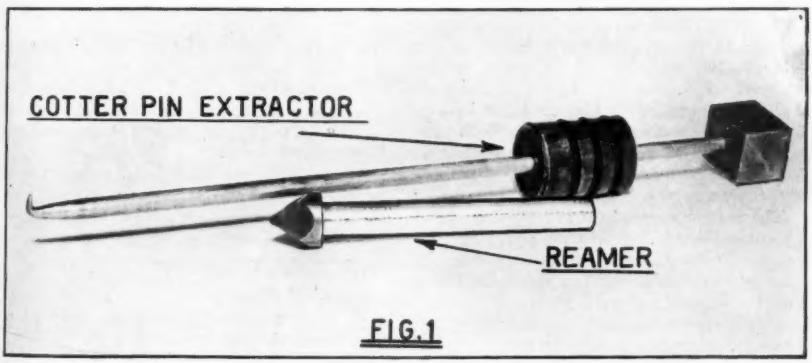


FIG. 1

Speed Reamer

In a shop where a number of pieces of copper tubing or pipe is required, as for charging lines or making up a valve panel, a speed reamer will be found an excellent way to speed up production.

Obtain a reamer, either from a tubing cutter or a regulation reamer with a stem. Mount it in a piece of steel tubing.

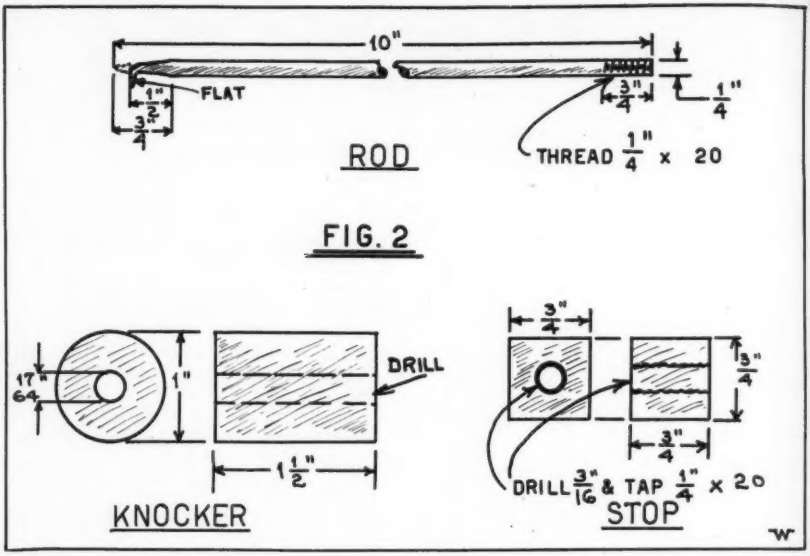


FIG. 2

Steel tubing can be purchased in such a wide variety of sizes that a piece can be secured which fits the end of the reamer tightly. To mount the reamer put it in "dry ice." Heat the steel tube to expand it. Assemble the two parts quickly and immerse in water to prevent drawing the temper from the reamer edges.

The reamer shown in the illustration (Fig. I) came from a tubing cutter and was already provided with a threaded stem. A thread to match was cut in the steel tubing and the reamer screwed in place.

Mount such a reamer in a motor of 1/8 h.p. or more. Have the motor tilted or, if the oil cups are so designed that the motor can be operated with the shaft upright, increase the tilt to about sixty degrees. This is to prevent the metal chips from falling into the tube while reaming.

The reamer is held in a three jawed chuck and reaming will be found to be both faster and smoother than secured by hand.

If desired, a pair of 2 x 4 timbers can be placed together, with a V groove between to act as a guide for tubing.

The "soft" cutting action of a four faced cutter, such as shown in the illustration, will result in a perfectly smooth face, which in turn assures the best flaring condition. If the tube or pipe is to be used in solder or threaded work where over-reaming is required, this method of reaming will prove a great time saver.

The use of the guide in V block is recommended, as it assures centering the reamer in the tube or pipe and will prevent the thinning of one part of the tube.

The illustrations provide all the necessary data that the builder will need to make up these aids to shop work.

\$ \$ \$

A USEFUL TOOL

A SCRAPER made of an old three-cornered file becomes a very useful tool for the service engineer.

Used principally as a bearing scraper and for scraping old gaskets from flanges and compressor parts, it will also be found useful as a reamer, and in many other little jobs encountered in service work.

Just hollow grind the three sides of a six or eight-inch three-cornered file until a sharp edge is obtained, and the end is tapered to a point. Provide the tool with a regular file handle, driven well onto the tang of the file.

\$ \$ \$

Joseph Lindstrom
Illinois

Enclosed find \$2.00 for another year's subscription. Your SERVICE ENGINEER sure is a fine set-up for anyone concerned with refrigeration.

Milk Cooling

By A. T. MURRAY *

THOUGH milk is very nearly free from bacteria at the time it leaves the cow, due to its temperature, it is a highly fertile field for the rapid growth of the bacterial organisms which cause spoilage. The growth of these organisms, and the preventative problem, is increased, because the nature of milk itself is such that bacteria multiply very rapidly. To check this growth, it is necessary to cool the milk to a safe temperature as rapidly as possible, while to kill the germs present and prevent further growth, it is necessary to pasteurize the milk first, and then cool. The temperature to which it must be cooled, and the time involved, is a matter of law in some communities, and in all communities from which it is delivered to large centers of consumption. In general, the milk must be cooled to a temperature not higher than 50 degrees, in not more than two hours after leaving the cow.

In rural sections where electricity is not available, it has been common practice to submerge the cans of milk in cold water, if available, obtained from springs and wells. Ice is also used as a means of cooling the water bath. State laws, however, are becoming more and more strict, so that it is becoming practically impossible to operate a successful milk business without mechanical refrigeration.

Methods of Milk Cooling

There are various processes for refrigerating milk, but because of the limited time within which the temperature must be dropped from about 95 degrees at which milk comes from the cow, to 50 degrees or below, all of these processes employ either direct or indirect refrigeration. A great deal of refrigeration is needed during a short period, and for this to be provided directly from a condensing unit would call for a very large machine. By storing up a reserve ability for heat removal in a large quantity of brine or water it is possible to do the same work with a condensing unit of moderate size.

Probably the most common and also the oldest method of mechanical cooling is to place the cans of milk in a submersion cooler, or a bath of water, the temperature of which has been reduced to between 35 and 38 degrees.

When tanks of moderate size are used with sweet water for immersion cooling, dependence for reserve capacity is placed upon ice frozen around the cooling coils in the tank. When the condensing unit operates with no milk being cooled, these coils gather ice to a thickness of one to two inches. When warm milk is placed in the water bath, the ice cares for most of the initial heavy load. Such methods are suited to handling twenty to one hundred gallons of milk per day when sold wholesale in cans.

Quick Cooling with Aerator

When employing an aerator or tubular cooler, warm milk is poured into the tank at the top and is allowed to flow through the faucet into a trough arranged above the pipe coil in such a way that the milk is evenly distributed, and flows uniformly down over all the tubing. Cold water or brine is circulated through the pipe coil and the milk, which has been cooled by contact with the metal, gathers in a second trough down below and flows into the can. The aerator coil may be divided into two sections, cold well or spring water flowing through the upper turns and refrigerated brine or expanding refrigerant flowing through the lower turns.

When well water or spring water at a temperature of 60 degrees is circulated through the aerator the milk can be brought down to a temperature of about 65 degrees, lower temperatures being impossible because of the relatively high temperature of this water as compared with a refrigerated supply. The milk from the aerator then is placed in the immersion tank cooler where the temperature is lowered from about 65 degrees to 50 degrees. Water which has passed through the cooler may be run to a tank, watering trough or waste pipe.

With a double section aerator connections are made to circulate well or spring water through the top half at a rate of three gallons of water or better to one gallon of

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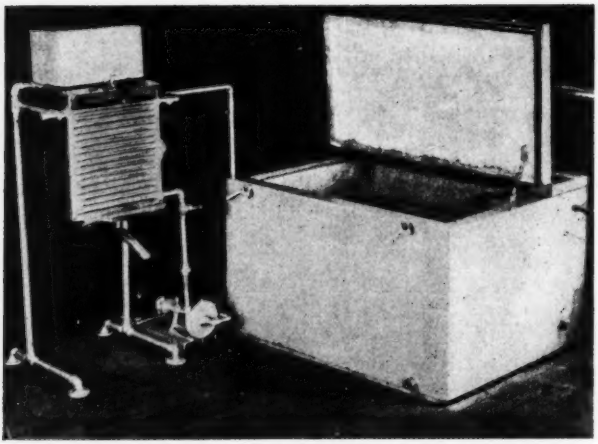


A typical submersion type milk cooler with the Aerator supported on a rack alongside. Note the circulating pump for circulating the brine through the Aerator.

milk, and direct expansion at a temperature of 33 degrees or chilled brine at a temperature of 20 degrees through the lower half. Using water not mechanically refrigerated for handling part of the load reduces the demand on the condensing unit and allows employing a smaller tank for a given job.

Aerators are made in all required sizes or capacities and of various styles. One approved design consists of seamless drawn tinned copper tubes arranged parallel to one another and sweated into bronze headers with return bends. In a two section cooler it is possible to attach a special return fitting bend between the bottom of the upper section and the top of the lower section to form one continuous passage. The troughs and other parts with which milk comes in contact are tinned.

The rate of cooling is determined by the temperature of water, brine or refrigerant flowing in the coils, by the size of the aerator, and by the amount of milk allowed to flow over the tubes in a given time. Reducing the flow of milk by means of the faucet will result in greater cooling of the quantity which does flow, other factors remaining unchanged. The flow should be such that the milk is cooled to within three to five degrees of the water temperature and 12 degrees of the refrigerant temperature.

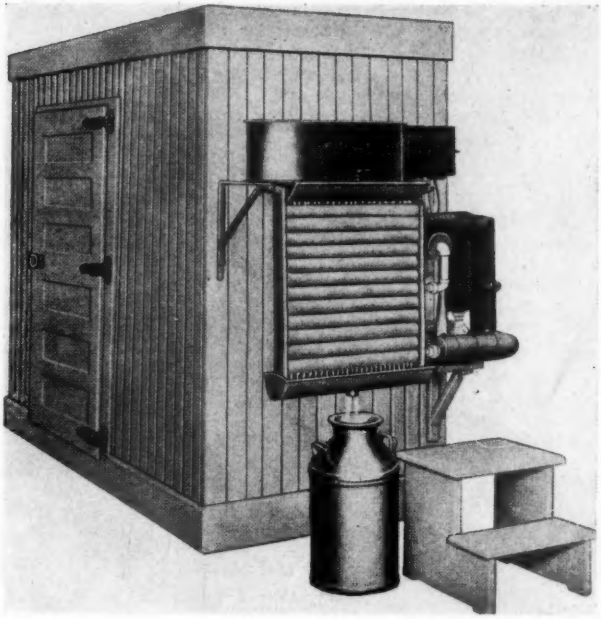
Factors Which Affect Cooling Load

One gallon of milk weighs 8.6 pounds; therefore it requires 7.912 B.t.u. to cool one gallon of milk one degree, and to cool one gallon from 95 degrees (cow temperature) down to 50 degrees requires 356 B.t.u.'s.

Cooling 10 gallons of whole milk from 95 degrees to 50 degrees thus requires 3560 B.t.u.'s or 24.7 pounds of refrigeration. To cool one 10-gallon can from 80 degrees (usual conditions) to 50 degrees, with a weight of 26 pounds per can at a .12 B.t.u. specific heat takes 93.6 B.t.u.'s or 0.65 pounds of refrigeration. To cool both the milk and the can takes 3653.6 B.t.u.'s or 25.35 i.m.e.

The very heavy load which exists during the first minutes of cooling may be realized from the following table showing the number of B.t.u.'s which must be removed from a single 10-gallon can of milk.

Temperature Change	Degrees Cooled	B.t.u.'s Removed	Time in Minutes	B.t.u.'s per Min.	B.t.u.'s per Hr.	I.M.E. Lbs. per Hr.
90 to 80 Deg.	10	791.2	10.5	75.4	4524	31.40
80 to 70 Deg.	10	791.2	12.5	63.3	3798	26.35
70 to 65 Deg.	5	395.6	7	56.5	3390	23.55
65 to 60 Deg.	5	395.6	10	39.6	2376	16.50
60 to 55 Deg.	5	395.6	20	19.8	1188	8.25
55 to 50 Deg.	5	395.6	35	11.3	678	4.70
50 to 45 Deg.	5	395.6	47	8.4	504	3.50
45 to 40 Deg.	5	395.6	158	2.5	150	1.04



Milk cooling system of the dry storage type with aerator mounted on the end of the box. The brine tank from which circulation for the aerator is obtained is installed inside the box, providing additional refrigeration during the storage period and eliminating the necessity of insulating the tank. Forced draft unit coolers or fin coils cool the box.

The heat removal rate to begin with is 31.40 pounds per hour during ten minutes. At the end of 40 minutes it is something less than 16.50 pounds, and at the end of an hour it has dropped to below 8.25 pounds per hour. The heavy load at the beginning will warm the water, and there must be enough of some other source of heat absorption to handle this load. If there is insufficient water or other heat removing reserve the water will warm up excessively, the temperature difference between milk and water will become too small, and the time for cooling will extend beyond the allowable limit. While we have here considered only the load due to cooling the milk, there must also be sufficient capacity to handle the load due to cans and also that required in caring for the heat leakage in the cooling apparatus in tanks or cabinets containing the milk during the cooling period.

Water or Brine for Cooling Tanks

Taking the specific heat of sweet water or tap water at 1.0, and the weight per gallon as 8.34 pounds, it is apparent that as one gallon of water warms one degree it will absorb or remove 8.34 B.t.u.'s from the milk or other substances with which it is in contact. If the water is to be allowed to increase its temperature 5 degrees, each gallon will absorb 41.7 B.t.u.'s during this temperature rise, and if the rise is to be limited to 5 degrees this is all the cooling we can obtain per gallon of water unless additional refrigeration is being used at the same time.

Frozen water, or ice, is quite another story. As you know, a pound of ice absorbs 144 B.t.u.'s of heat in changing from 32 degrees into 32 degree water. Therefore, for every pound of ice we have in a cooling tank to begin with, we have a reserve cooling capacity of 144 B.t.u.'s. A gallon of water, or 8.34 pounds of water, which has been changed into ice contains a reserve capacity for removing 1201 B.t.u.'s of heat as it melts without changing the temperature. A great many milk coolers are designed and operated to build up a certain sized ice cake around the coils, which allows them to have the needed reserve ability with a smaller volume of water than when water is used only in the liquid state.

Brine often is used in place of sweet water because with brine it is possible to carry a greater reserve cooling capacity. Brine, using three pounds of calcium chloride per gallon, has a specific heat of 0.7. One gallon of this brine weighs 10 pounds. Therefore, a

rise of one degree temperature in one gallon of such brine means the absorption of 7.0 B.t.u.'s, as compared with the 8.34 B.t.u.'s absorbed by one gallon of sweet water. For the same heat removal with the same temperature rise we would use 1.19 gallons of brine or 1.0 gallon of sweet water. The reason it is possible to carry a greater cooling reserve in brine is because it may be used at very much lower temperatures than the sweet water without freezing. This lower temperature in the brine gives us a greater temperature difference between brine and milk than between water and milk. The greater temperature difference speeds up the rate of heat transfer from the milk and a given job is done in less time.

When sweet water from the cooling tank is to be used in the aerator it is possible to employ a very much smaller tank than one needed for brine provided a good portion of the sweet water is changed to ice and held ready for the cooling load. When ice is to be formed it is necessary that the refrigerant coil be so placed in the tank as to allow the forming of large coatings of ice around the tubing without interfering with free flow of water through and around the coils while it is being pumped through the aerator.

Example

We might consider a job in which it is necessary to cool 100 gallons of milk from 95 degrees to 50 degrees at a single operation. At the rate of 356 B.t.u.'s per gallon, this would mean the extraction of 35,600 B.t.u.'s for the 100 gallons. Supposing we have a 100-gallon water tank and arrange to freeze one-third of the water in advance. The weight of 100 gallons of water is 834 pounds. One-third of this is 278 pounds, and 278 pounds of ice will absorb 40,032 B.t.u.'s of heat when melting into 32-degree water. If we allow a rise in temperature of only 5 degrees, which is small when starting from freezing, our 100 gallons of water will absorb an additional 4170 B.t.u.'s which gives a total cooling ability of 44,202 B.t.u.'s. This capacity in the ice and water alone, without added refrigeration, is considerably in excess of our assumed load of 35,600 B.t.u.'s for milk cooling, so there would be no difficulty in caring for other specific heat loads and ordinary leakage loads with a flow of one gallon of water for each gallon of milk to be cooled. In practical application of such an arrangement we would have to make sure the refrigerating machine would cool the water and freeze the required amount of ice between the time when the milk is to be cooled. When using sweet water it is practically impossible to get the temperature of the milk below 40 degrees as it leaves the aerator.

If an ice cake is not employed we must use a greater volume of water or a greater volume of brine. Again taking the problem of cooling the 100 gallons of milk through a range of 45 degrees, which calls for removal of 35,600 B.t.u.'s we could remove this heat with sweet water alone. As previously mentioned, allowing a 5-degree rise in water temperature means that each gallon absorbs 41.7 B.t.u.'s. To remove 35,600 B.t.u.'s then would take about 850 gallons of water. If, instead of a 100-gallon size we had a 500-gallon water tank, we would have to remove $\frac{35,600}{500}$ which equals 71.2 B.t.u.'s per gallon. Each 8.34 B.t.u.'s per gallon would mean one degree rise in temperature, so we divide 71.2 by 8.34 to find that with the 500 gallons of water we would have a rise of about 8½ degrees. Although a 5-degree rise is desirable, one of 8½ degrees is not considered objectionable.

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The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box."

SHUTTING DOWN A SYSTEM

QUESTION 263. In a shut-down of a household refrigerator SO_2, F-12, methyl chloride—cut motor out of circuit and close the compressor inlet and outlet valves. Now in commercial refrigeration SO_2, F-12, methyl chloride jobs, on a shut-down, is there more to be done than to cut motor off and close compressor inlet and outlet valves?

ANSWER: In shutting down either a household or commercial system, I believe the same procedure should be followed wherever possible, as follows:

The receiver valve should be closed, and the system entirely pumped down so that all the gas may be contained in the receiver. A head gauge should be installed, of course, and observations made to see that the receiver is large enough to hold a complete charge. On some of the older type machines installed on multiple systems, the receiver was not large enough to hold all of the charge, and, therefore, it is impossible to pump it entirely down. When the system is pumped down to zero, both the suction and pressure discharge valves should be closed.

In all water-cooled systems, water should be drained from all parts of the machine to prevent freezing in case of low temperatures. Refrigerated spaces should be left open, so that they may dry out, thus preventing the forming of mold and consequent bad odors.

I cannot recall any further precautions that should be taken apart from those you have mentioned.

MOISTURE TROUBLES

QUESTION 264. I noticed in your last Question Department, an answer to a question about sticking up of methyl jobs. I am very much interested, as I have a problem of this nature myself.

My customer has a Gebhardt ice cream freezer, equipped with a one-horsepower Universal water-cooled machine about two years old. For the past year, he has had trouble with his compressor sticking. I removed the compressor and washed it internally with alcohol, as I have had to do on several other jobs, and was apparently successful, as the job ran fine for about a month. Now, however, I find that while he can use the freezer without any trouble at all, the minute he allows the machine to operate on the hardening cabinet (which is in conjunction) long enough to cut off on the thermostat, it will stick tight when the control cuts it on again. If you should think it necessary to wash out the coil in the hardening cabinet, I would thank you to advise me of some proven and efficient method of doing so.

ANSWER: We are quoting in the following, the opinion received from the Assistant Service Manager of the Universal Cooler Corp.

"Since the question submitted does not state whether the refrigerant used was methyl chloride or Freon, we assume it to be methyl chloride. We all know that when methyl chloride is used and moisture in any quantity is permitted to enter the system, an acid condition results, which not only breaks down the lubricating qualities of the oil, but also sludges it considerably. If the moisture content is great enough, and sufficient heat is developed, this acid formation may be strong enough to free some of the copper in the system, and cause it to plate on any point in the compressor, particularly where sufficient heat is developed to complete the hydrolysis.

"This copper plating, of course, builds up on main bearing surfaces and cylinder walls and pistons. In itself, it would tend to tighten up the compressor operation, and this condition combined with oil that is sludged, causes the compressor to stick.

"If the oil sludging and copper plating is not too far advanced, generally a thorough cleaning with carbon tetrachloride will clear up the situation. If there is a considerable amount of this evidence present, about the only thing that will cut this formation is alcohol.

"It is satisfactory to use alcohol for this purpose, but we caution the user against

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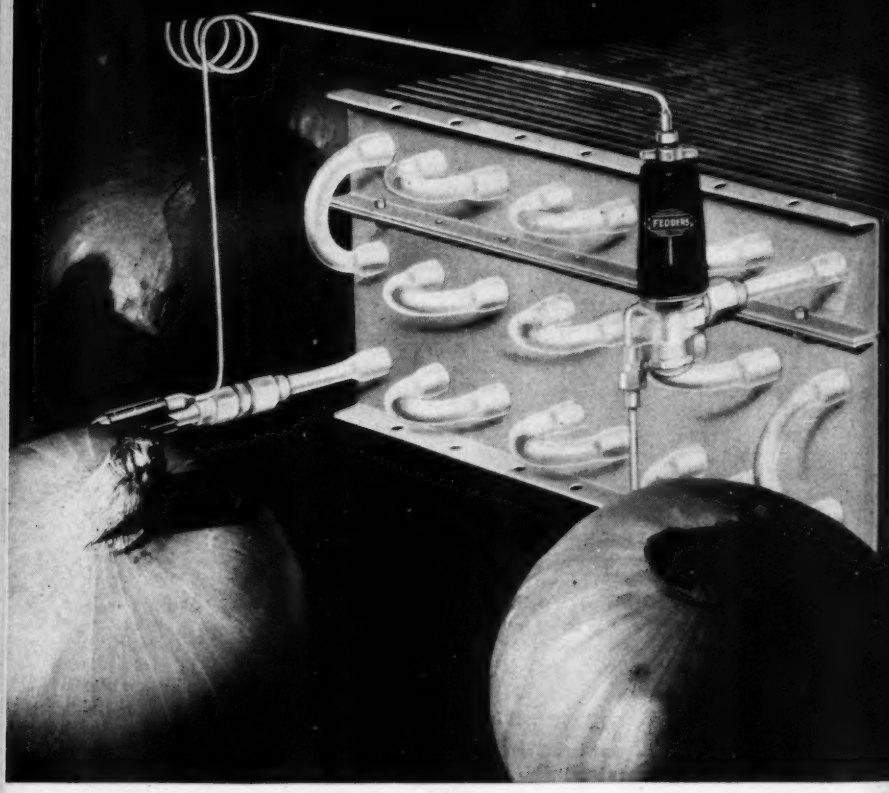

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permitting any of it to remain in the system. We recommend that after the system has been thoroughly cleaned with alcohol, it be submitted to a drying process in a bake oven, if such a procedure is at all possible. If not, then air that is heated through a coil should be passed through the system until all traces of alcohol are removed.

"It is dangerous to add alcohol to a system containing methyl chloride, as while it may relieve the moisture condition as far as freeze-up is concerned, its presence will continue the formation of acid, which will only result in future difficulty. There is also the possibility of methyl formate being formed which, of course, is very injurious to health."

I believe this answers your question fairly thoroughly, with the exception of how to clean this coil, if such becomes necessary. I would suggest, as one method, that a length of tubing be soldered to a funnel, and connected to the upper connection of the cabinet coil, so that the funnel is several feet above the cabinet. Using alcohol as a cleaning agent, you may pour it into the funnel, allowing it to run through the coil by gravity, and catching it at the other end. Circulating several gallons in this manner should, I believe, do a fairly good job of cleaning. Blowing out the coil thoroughly with methyl chloride to remove the alcohol, then pulling a high vacuum on it, and heating, if possible, I believe should do a fairly good job of removing the alcohol.

As stated in the answer given by Universal Cooler Corp., too much care cannot be taken in removing this alcohol from the system. Therefore, I would make very sure that your heating process and the vacuum are maintained over a sufficient period of time to insure its removal.

I believe it would also be a good idea to install a drier in the liquid line, after recharging with oil and gas.

STUCK UP JOB

Question 265. What is the best thing to do with a "stuck-up" system? Is there any practical way to loosen a "stuck-up" compressor without taking it apart? Another refrigeration service engineer told me he can loosen one in three minutes. Do you think this is so?

I just overhauled a Kelvinator compressor that was "stuck-up" and I changed the evaporator and put in new SO_2 and oil. Do you think any of this expense could have been avoided on my part?

The Kelvinator mentioned above has a lowside float, which would stick either open or closed. That is why I had to change the evaporator.

Answer: I don't believe you went to any excessive work in the problem you described with the Kelvinator.

In my opinion, there is no substitute for a properly overhauled and thoroughly cleaned job to overcome a stuck-up condition. In all probability, the gentleman, who stated he could loosen a stuck-up compressor in three minutes, was referring to the use of Xylene, which, as you possibly know, can be used in small quantities in a refrigerating system to do just such a thing.

Xylene is a fairly good solvent for the carbon sludge forming under these conditions. It does not remove the carbon, but permits it to circulate through the system. You can readily see that this would create a very dirty system, and would possibly cause trouble at screens and needle valves at a future date.

Again, I repeat, that for a permanent job, there can be no substitute for a thorough overhauling and cleaning, and then recharging with clean oil and refrigerant.

CROSS CONNECTING TWO MACHINES

Question 266. Enclosed you will find a sketch. Fig. 1. I have a job with a unit cooler on a 1-hp. SO_2 water-cooled condensing unit which, of course, is twice too large for the cooling unit, and a fin coil on a ½-hp. SO_2 water-cooled condensing unit. They both work under the same, or like, conditions, same temperature, etc.

It is my desire to connect these units so that a workman in the plant where this outfit is installed may, by opening and closing one or two sets of valves, have either of the condensing units operate either, or both, cooling units, or each condensing unit operate on one cooling unit. This would be in case of emergency only.

Will the liquid refrigerant equalize itself in the two receivers by the equalizing line, or will the liquid pile up in the one receiver?

These units cool a valuable product where a constant temperature must be kept, and a difference of ten degrees rise in temperature would seriously affect the material. It is my desire, in case of a breakdown, to have one machine operate both cooler and coil.

Answer: If I understand your requirements properly, I don't believe the hook-up

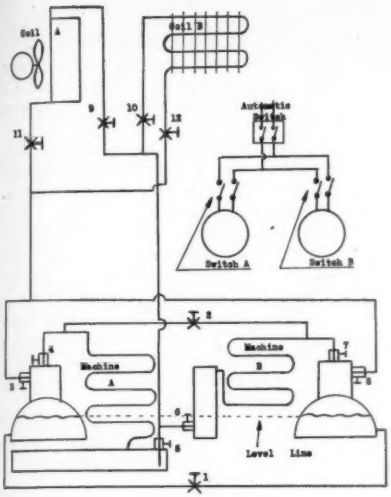

FIG. I.

you have shown will work satisfactorily because, while both of the machines are operating, most of the gas will accumulate in the coldest condenser. The oil may all drain from one compressor and accumulate in the other, and due to the wiring hook-up, and the difficulty of setting both of the controls exactly alike, one of the machines may never start.

In order to overcome these difficulties, a line with a valve in it must be installed from a point between the compressor and condenser of one machine to a similar point on the other machine, so that the pressures in each will always be alike. The proper oil level must be determined for each compressor, and then the machines raised or lowered so that both oil levels are at the same height, and an oil equalizing line, with a valve in it, should be tapped into the compressor below the oil level of each. Both machines should be operated from one automatic switch, with a manual switch between it and each motor as shown in the wiring diagram. The entire hook-up should be as shown in the accompanying sketch. A total of six hand wheel valves will have to be installed, which will permit a sufficient flexibility so that the machine and coils may be operated in any combination desired.

Examples of these operations would be as follows, and I would suggest that an instruction sheet, outlining all the various operations, be posted near the machine for the operator's benefit. All valves, of course, should have metal tags attached to each, bearing the number of the valve.

Instructions

To operate both coils in both machines, all valves must be open.

To cut machine "B" and operate machine "A" on coils "A" and "B," open switch "B," close valves 1, 7 and 8.

To operate machine "B" on coils "A" only, open switch "A," close valves 1, 3, 4, 10 and 12.

I believe you will find such a hook-up will permit the isolation of any part of the system without interrupting service to the entire system.

I notice in your sketch, you show the inlet to each evaporator at the bottom, which will produce a partly flooded condition of the coils. I believe better results would be obtained if the inlet were changed to the top of the coil, as shown in the accompanying sketch, making a dry type of system.

ICE FORMATION ON COILS

QUESTION 267. The information I am seeking is in connection with several last year Seeger display cases, which are in different locations, and several hooked on the same unit with other equipment, which function okay. These are all equipped with Carrier highsides, and the refrigerant controls are Detroit and Fedders thermostatic expansion valves.

The trouble I am having is that the coils jam up with ice in warm weather. The fins on these coils seem to be too close together, and hold the water during the first few defrost cycles. Then is when the coils begin to jam up. The distance between the fins is ¼-inch. How can I correct this trouble?

ANSWER: The fact that the fins are only ¼ of an inch apart is not, in my estimation, the cause of your trouble. This, of course, will contribute to the speed with which the coil will fill with ice, but regardless of the spacing of these fins, the ice will still accumulate.

Evidently your trouble is due to a rather long running period, and a short idle period, which does not permit this coil to warm up sufficiently to remove the ice during the off-period. If it is possible to set the pressure control to a wider range, permitting the coil to warm up to above 32°, I believe you will overcome your trouble. If, however, it is impossible to do this, due to the nature of

the other coils in the system, it may be necessary to install a two-temperature, snap-action valve on the display case, setting it for a wide enough range so that the ice will melt off during the idle period.

Since you did not tell me what kind of gas is being used, there is no possibility of my telling you what this range should be.

ADVANTAGE OF CHANGING FROM SO_2 TO F-12

Question 268. I have had several customers inquire about changing sulphur dioxide charged refrigerating systems to use F-12 refrigerant.

One customer has a ½-hp. Kelvinator, sulphur dioxide unit, approximately four years old, operating in connection with a thermostatic expansion valve and finned evaporators in a meat display case.

He wants to know if the expense in cleaning and charging the system would be offset over a period of years by reduced operating costs and machine life. Would the same compressor body operate satisfactorily with F-12 refrigerant?

Answer: In order to change a sulphur dioxide machine to an F-12 system, it is necessary to do the following:

Thoroughly clean and dehydrate the system, change the oil, increase the size of the motor from ½ to ¾-hp., increase the spring tension on the seal, and possibly increase the condenser size.

As you can readily see, the expense of such a change-over will be fairly high, and unless it is desirable to have an increased capacity in the machine so that additional coils could be added, there is no advantage, in my estimation, of making this change.

The operating cost for a given load would be the same on each. The only advantage to be gained in making such a change is the increased capacity of the machine. If I understand your problem properly, there is no such need in your case.

MAYFLOWER TROUBLES

Question 269. I have a model G.p. 5 Mayflower refrigerator in my shop. This machine has a lowside float and a model A-105 twin-cylinder compressor. It has a charge of 4½ lbs. SO_2.

I attached my gauges to this unit and found the following: With 60 lbs. head pressure, I could only get a 10 lbs. pressure off the lowside, with the compressor suction service valve closed. I relieved the head pressure, and could draw 20 inches of vacuum. I took the compressor apart, and found the suction and discharge in very good shape, and did not find anything under these valves. I also found the piston has no rings.

I have also removed the float assembly, and found the seat and needle valve pitted, and quite a bit of oil in the evaporator. What is the proper amount of oil that should be in the evaporator? This oil looks bad and very dark in both the evaporator and compressor. Is this float valve a Mullins? I also found the porcelain around the front of the valve coming off, and the valve head looks discolored, but was unable to find a leak of SO_2. What is the reason for this?

In regard to the compressor, what would you suggest doing with it?

There are a few of these machines around here, and they all complain of long running time. Is there anything that can be done to cut down running time?

Answer: Prior to 1936, the Mayflower refrigerator was manufactured by the Trupar Manufacturing Co. This company was purchased in 1934 by Dallas Winslow, Inc., of Detroit, who also purchased the Copeland Refrigeration Corp. In 1936, Mayflower, Inc. was formed, and the company manufactured a refrigerator under this name.

The Model A-105, which you describe, was manufactured in 1934, and I, therefore, take it for granted that the Trupar Manufacturing Co. (the original company located in Detroit) would still carry parts for this machine. The new company, Mayflower, Inc., does not use the same compressor, and would possibly not have the parts for the machine manufactured prior to their purchase.

The model you describe is equipped with a Mullins evaporator, using SO_2 as the refrigerant. The compressor requires one pint of Sunisco No. 3 oil. Any lowside evaporator should not contain more than a ¼-in. layer of oil, which floats on top of the gas. This will probably represent about ½ cup full, which you would find in the evaporator after pumping all the gas off.

The deterioration of the enamel around the float head is probably caused by a slight seepage of the gas through the lead gasket at this point, and will usually not be sufficient to be detected through any leak detection methods, but over a long period of time, such as two or three years, will show on the porcelain.

Since you have thoroughly checked your valves in the compressor, and find them to

be okay, it leaves only two possibilities open as a source of your trouble. First, that the compressor has not sufficient oil, and the pistons and valves are running fairly dry. Second, the pistons are worn sufficiently, and due to the fact that there are no rings on them, gas may be blowing past these pistons. The first possibility, of course, is very easily checked, and the amount of oil has been stated before. If you find that the pistons are loose, it is quite possible to take these to a machine shop, and get grooves cut in the pistons so that rings may be installed, or if you care to go to a more extensive job, the cylinder walls will have to be rehoned and oversized pistons installed.

Design Data on The Thermostatic Expansion Valve

By GEO. H. CLARK *

THE original thermostatic expansion valves as manufactured by Detroit Lubricator consisted of the automatic expansion valve plus the thermostatic adjustment. Figure 1 shows a valve of this type. The adjusting spring and screw of the American

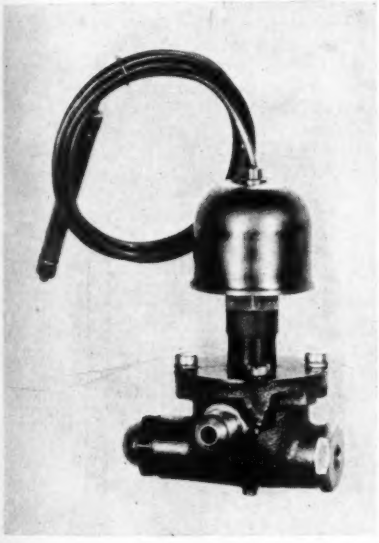

FIG. I.

Radiator type automatic expansion valve has been replaced by the power element consisting of a bellows in the brass cup connected to the thermal bulb by a capillary tube and to the expansion valve bellows by a push rod. The gas pressure in the bellows acts as an adjusting spring except that the spring force may be varied by a change of bulb temperature which will change the pressure in the bellows. Thus the lower the bulb temperature, the lower the power element pressure and this acts through the push rod to cause a lower refrigerant pressure in the evaporator.

Bellows Ratio

The early valves had a power element bellows of the same size as the expansion valve bellows. Consequently, when the temperature of the thermal bulb was raised 1 degree a certain change in pressure took place in the power element. It should be kept in mind that the pressure exerted by a refrigerant depends upon the temperature at the liquid and vapor surface of the refrigerant. In the valve shown two cubic centimeters of a thermostatic liquid were charged into the power element. The bulb being maintained at a temperature lower than the valve end of the power element retains the liquid which will always go to the coldest part of the power element.

The thermal bulb pressure then changes with temperature. If the pressure went up 1 pound in the power element bellows it would increase the force tending to open the valve. Thus the pressure in the evaporator would have to build up 1 pound in order to balance the increased pressure in the power element.

Figure 2 shows the present type of thermostatic expansion valve. If this valve had the same size bellows at H as at K and the valve was set for 10 degrees superheat at a

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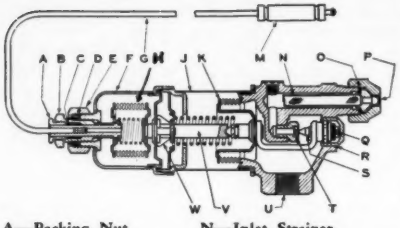


A—Packing Nut.
B—Adjusting Nut.
C—Packing.
D—Packing Around Adjusting Screw.
E—Packing Nut.
F—Power Element.
G—Capillary Tube.
J—Stainless Steel Extension.
K—Body Bellows.
M—Feeler Bulb.
N—Inlet Strainer.
O—Strainer Gasket.
P—Inlet Connection.
Q—Needle Swivel.
R—Plug Hermetically Sealed.
S—Delubaloy Needle.
T—Delubaloy Seat.
U—Outlet Connection.
V—Push Rod.
W—Anti-Chatter Device.

FIG. 2.

32 degree bulb temperature, the action would be as follows:

With the valve just balanced to throttle a small amount of refrigerant through with a 32 degree methyl charged bulb the pressure in the bulb would be 22 pounds gauge. The outlet pressure would be 15 pounds gauge to give 22 degrees evaporation for methyl chloride. The superheat is then 32 degrees—22 degrees or 10 degrees. If the bulb temperature was lowered to 0 degrees the pressure in the bulb would then be about 4 pounds or would change from 22 to 4 pounds or 17 pounds. If the pressure in the valve bellows K and the evaporator was lowered the same amount the final pressure would be 15 pounds —17 pounds or —2 pounds or four inches vacuum. This would give an evaporation temperature of —16.5 degrees. The superheat would then be 0—(—16.5) or 16.5 degrees. On the other hand, if the bulb was raised to 70 degrees the pressure in the power element would be 58 pounds or 36 pounds higher than the original 22 pounds. If we raise the original evaporator pressure of 15 pounds by 36 pounds we will have a final balanced condition with a 51 pound pressure in the evaporator. This gives an evaporation temperature of 64 degrees when the superheat is 70—64=6 degrees.

Experiments with a number of refrigerating systems have shown that 10 degrees of superheat work out to give ideal conditions in the greatest number of cases. In Figure 3 where the system is starting out at high temperatures such that the superheat might be as low as 6 degrees, it is found the refrigerant feeds through too fast or may flood back in the suction line outside of the cooler.

By the time the bulb has been reduced to 32 degrees and a 10 degree superheat is obtained the coil is working perfectly with a frost line at A. When the bulb has been reduced to 0 degrees F. the valve has 16.5 degrees superheat and may only refrigerate properly as far as B, or in other words, the coil is partially starved of refrigerant.

If the valve is adjusted to give a 10 degree superheat at 0 degree bulb, it is found the coil will be fully refrigerated to A giving perfect coil operation.

Since it was recognized that in most instances a constant superheat of 10 degrees is desirable it was decided to build a valve which would give this action. Table I shows the variation in superheat that is obtained with a valve having the same effective area in the power element as in the valve body and being charged with the same refrigerant that is to be used in the system.

An explanation of the reasoning involved in theoretically showing the reason for the action a valve gives according to the following tables is as follows:

Column No. 1 indicates the evaporating temperature in degrees F.

Column No. 2 indicates the evaporating pressure from a temperature pressure chart for the refrigerant used in the system.

Column No. 3 indicates the force exerted by the valve body element tending to close the valve. Referring to Figure 2, the figures of Column 4 show the pressure indicated by Column 2 times the effective area of bellows K.

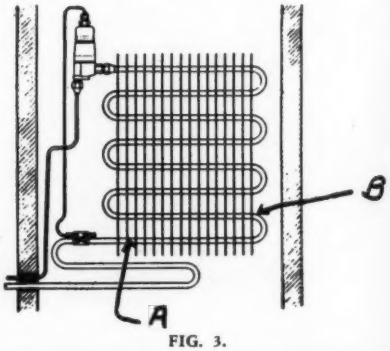


FIG. 3.

Column No. 4 is the net result of all spring forces in the direction indicated by the arrow. In the first table it is the net force of springs I, L, and any spring force in both bellows H and K and is in the direction tending to close the valve.

Column No. 5 indicates the total force tending to close the valve and the exact

force the power element bellows must exert to just keep the valve in balanced condition. It is also equal to the pressure in the bellows H times the effective area of that bellows.

Column 6 indicates the pressure in the power element bellows H. This is the pressure due to the temperature at the surface of the liquid and vapor in the feeler bulb M. It is also equal to the force indicated in Column 5 divided by the effective area of bellows H.

Column 7 is the thermal bulb temperature which will give the pressures indicated by Column 6.

Column 8 shows the superheat setting of the valve and is the bulb temperature as given in Column 7 less the evaporation temperature from Column 1.

With a one square inch effective area for each bellows and using a methyl chloride charge and methyl chloride as the refrigerant in the system the superheat calculations work out as in Table I.

It will be noted that the superheat varies from 6 degrees at high temperature conditions which would tend to cause a floodback to 20.2 degrees at low temperature conditions which would tend to starve the coil.

In order to correct this condition the bellows sizes were changed so that the area of the bellows in the valve body is 1.16 square inches as compared to one sq. in. of area of the power element bellows. Now the same procedure can be gone through to determine how the superheat will work out. The difference in this case is that Column 2 figures have to be multiplied by 1.16 to get the force indicated in Column 3.

In comparing Tables I and II it is noticed that throughout an operating range of evaporating temperatures of —20 to 60 degrees F., the superheat in valves having a single flexible element or having two flexible elements of the same effective area gives a superheat variation of 20.2—6=14.2 degrees

TABLE I

Col. 1	*Col. 2*	*Col. 3*	*Col. 4*	*Col. 5*	*Col. 6*	*Col. 7*	*Col. 8*
Evap. Temp. ° F.	Evap. Pr. Lbs./Sq. In.	Body Bellows Force Lbs.	Net Spring Force Lbs.	P.E. Force Lbs.	P.E. Pr. Lbs./Sq. In.	Feeler Bulb Temp. ° F.	Superheat ° F.
		←	←	→			
22°	15	15	7	22	22	32	10
—20°	6 in.	—3	7	4	4	0.2°	20.2°
0°	3.9 lbs.	3.9	7	10.9	10.9	14.5°	14.5°
20°	13.8 lbs.	13.8	7	20.8	20.8	30.5°	10.5°
40°	28.2	28.2	7	35.2	35.2	48.5°	8.5°
60°	46.8	46.8	7	53.8	53.8	66°	6°

In Table I the spring force is determined when we have an evaporation temperature of 22 degrees with a bulb temperature of 32 degrees. Data below the line is determined for various evaporation temperatures using the spring force as determined above.

while the valve having a ratio in flexible members of 1.16 to 1 gives a corresponding superheat variation of only 12.7—10=2.7 degrees.

Table II indicates a means of considering what would happen if a methyl chloride

TABLE II

Col. 1	*Col. 2*	*Col. 3*	*Col. 4*	*Col. 5*	*Col. 6*	*Col. 7*	*Col. 8*
Evap. Temp. ° F.	Evap. Pr. Lbs./Sq. In.	Body Bellows Force Lbs.	Net Spring Force Lbs.	P.E. Force Lbs.	P.E. Pr. Lbs./Sq. In.	Feeler Bulb Temp. ° F.	Superheat ° F.
		←	←	→			
22	15	17.5	4.5	22	22	32	10
—20	6 in. or —3 lbs.	—3.5	4.5	1 lb.	1	—7.3	12.7
0	3.9	4.5	4.5	9.0	9.0	10.7	10.7
20	13.8	16.0	4.5	20.5	20.5	30	10.0
40	28.2	32.7	4.5	37.2	37.2	50.7	10.7
60	46.8	54.3	4.5	58.8	58.8	71.0	11.0

TABLE III

Col. 1	*Col. 2*	*Col. 3*	*Col. 4*	*Col. 5*	*Col. 6*	*Col. 7*	*Col. 8*
Evap. Temp. °F.	Evap. Pr. Lbs./Sq. In.	Body Bellows Force Lbs.	Net Spring Force Lbs.	P.E. Force Lbs.	P.E. Pr. Lbs./Sq. In.	Feeler Bulb Temp. ° F.	Superheat ° F.
22°	3.3	← 3.8	← 18.2	→ 22	22 lbs.	32°	10°
—20	17.6 in.	→ 10.4	18.2	→ 7.8	7.8	8.5°	28.5
0	—8.8 lbs	→ 5.1	18.2	→ 13.1	13.1	18.8	18.8
20	8.7 in.	← 2.9	18.2	→ 21.1	21.1	30.9	10.9
40	—4.35 lbs.	← 14.4	18.2	→ 32.6	32.6	45.5	5.5
60	2.5 lbs. 12.4 lbs. 26.2 lbs.	← 30.4	18.2	→ 48.6	48.6	61.5	1.5

valve was used on a sulphur dioxide system. In this case the pressure in Column 2 is that corresponding to evaporation temperatures for sulphur dioxide. The pressure in Column 6 is still that corresponding to methyl chloride as the power element is charged with methyl.

Table III shows a low superheat at high temperatures and a high superheat at low temperatures. This would cause a flood-back condition at high temperature conditions and a starved coil at low temperature conditions.

A sulphur valve on a methyl system would work differently in that at high temperatures the coil would be starved while at low temperatures it would frost back.

Table IV shows a number of combinations of bellows ratio, superheat adjustment, and thermostatic charges on various refrigerants and resulting operation in each case.

TABLE IV

	COMBINATIONS				COIL CONDITION		
No.	Refrigerant in Power Element	Refrigerant in System	Bellows Ratio Power Element Bellows to Valve Body Bellows	Superheat Setting with 32° Bulb	At Low Temp.	Med. Temp.	High Temp.
1	Methyl	Methyl	1:1	0°	Flooded	Flooded	Flooded
2	Sulphur	Sulphur	1:1	0°	Flooded	Flooded	Flooded
3	Freon	Freon	1:1	0°	Flooded	Flooded	Flooded
4	Methyl	Methyl	1:1	10°	Slightly Starved	Normal	Slightly Flooded
5	Sulphur	Sulphur	1:1	10°	Slightly Starved	Normal	Slightly Flooded
6	Freon	Freon	1:1	10°	Slightly Starved	Normal	Slightly Flooded
7	Methyl	Methyl	1:1.16	10°	Normal	Normal	Normal
8	Iso-Butane	Sulphur	1:1.16	10°	Normal	Normal	Normal
9	Freon	Freon	1:1.16	10°	Normal	Normal	Normal
10	Methyl	Freon	1:1.16	10°	Flooded	Normal	Normal
11	Sulphur	Freon	1:1.16	10°	Flooded	Normal	Starved
12	Methyl	Sulphur	1:1.16	10°	Starved	Normal	Flooded
13	Freon	Sulphur	1:1.16	10°	Starved	Normal	Flooded
14	Sulphur	Methyl	1:1.16	10°	Flooded	Normal	Starved
15	Freon	Methyl	1:1.16	10°	Flooded	Normal	Flooded
16	Sulphur	Freon	1:1	10°	Flooded	Normal	Starved
17	Methyl	Freon	1:1	10°	Normal	Normal	Normal
18	Methyl	Sulphur	1:1	10°	Starved	Normal	Flooded
19	Freon	Sulphur	1:1	10°	Starved	Normal	Flooded
20	Sulphur	Methyl	1:1	10°	Slightly Flooded	Normal	Slightly Starved
21	Freon	Methyl	1:1	10°	Slightly Starved	Normal	Slightly Flooded

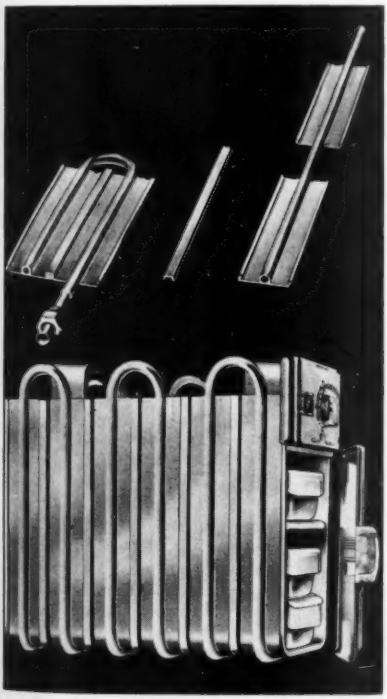
NEW MECHANICAL DEVICES
Service Tools and Special Equipment

Under this heading there will be published illustrated descriptions of new or improved service tools and equipment for the Service Engineer. Information contained in this department is furnished by the manufacturer of the article described and is not to be construed as the opinion of the Editor.

UNIVERSAL COOLER DEVELOPS NEW TYPE COOLING COIL

TO MEET today's demand for improved products at lower cost, Universal Cooler Corporation, Detroit, pioneers and manufacturers of electric refrigeration equipment, have developed a new type cooling coil, which is adaptable to all household refrigerators, and a wide variety of commercial refrigeration applications.

The new coil is made of virgin aluminum, extruded by a patented process into continuous tubing, with two integral parallel flanges which are responsible for the efficient performance of the product. These extruded sections are clamped together with a locking device of the same metal in such a way that it presents one continuous smooth flat surface on the inside of the cooling compartment. Designed for high speed production, it has several important advantages over the conventional type evaporators now in use. The evaporator was designed by Universal Cooler engineers, working in conjunction with the engineering department of the Bohn Aluminum and Brass Corporation, and is covered by basic patents.



NEW UNIVERSAL COOLER EVAPORATOR

The new Universal Cooler extruded aluminum evaporator is attractive in appearance, of sturdy construction, easy to keep clean and sanitary, and being aluminum is very light in weight. Continuous tubing eliminates welded or soldered joints, thus resistance to the flow of refrigerant through the system is reduced and compressor performance improved. The continuous construction of the coil also eliminates the hazards of leaks. Its unique design materially increases the amount of effective cooling surface, and the high conductivity of the metal provides greater cooling capacity and faster freezing.

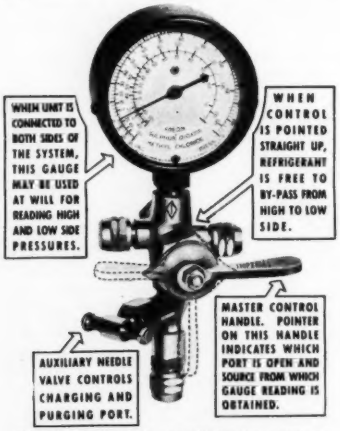
In addition to models for household electric refrigerators, it has already been developed for several types of commercial applications including bottled beverage coolers, plate coils for meat display cases, self-contained water coolers, sweet water bath draft beer coolers, dry storage bottled beverage coolers, and milk coolers.

The product is available for all types of household and commercial refrigeration evaporator applications.

THE NEW IMPERIAL HI-LO CHARGING AND TESTING UNIT

THIS unit, known as the Imperial No. 500-C Hi-Lo charging and testing unit, is an entirely new type of unit using a single

gauge and single valve to read pressures on both sides of the system. It will do everything a double gauge unit will do with the advantage of having the lightness, compactness, and ease of handling of a single gauge unit.


WHEN UNIT IS CONNECTED TO BOTH SIDES OF THE SYSTEM, THIS GAUGE MAY BE USED AT WILL FOR READING HIGH AND LOW SIDE PRESSURES.
WHEN CONTROL IS POINTED STRAIGHT UP, REFRIGERANT IS FREE TO BY-PASS FROM HIGH TO LOW SIDE.
MASTER CONTROL HANDLE. POINTER ON THIS HANDLE INDICATES WHICH PORT IS OPEN AND SOURCE FROM WHICH GAUGE READING IS OBTAINED.
AUXILIARY NEEDLE VALVE CONTROLS CHARGING AND PURGING PORT.

NEW IMPERIAL CHARGING AND TESTING OUTFIT

Among the special advantages are: (1) When connected to both sides of the system it will give the pressure reading of either side with a single gauge and a single valve. (2) It permits by-passing at any time without capping the charging and purging port. (3) It may be used separately on either the high or low side with maximum convenience.

The Hi-Lo is exceptionally speedy and simple to use. It has a master control handle which operates a double-acting valve. When this handle is turned so that its pointer is toward the high side connection, the high side port is opened and the high side pressure reading appears on the gauge. When it is turned toward the low side connection, that port is opened and the low side pressure appears on the gauge.

Only a half turn of the control, requiring a split second, is required to switch from the high side to the low side. By setting the control pointer directly upward a by-pass is effected.

An auxiliary valve is incorporated in the design of the Hi-Lo which controls the charging and purging port at the center.

Valve body and control handle are brass forged. The stem is made of steel and is of the heavy-duty, double-setting type. Valve seats are extra large allowing a full opening to both sides. The triple-lead thread on the stem assures fast, positive valve action.

The Hi-Lo comes equipped with a 30-inch to 150 lbs. compound gauge with temperature scale. Complete details may be obtained by writing to The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.

NEW FLARING AND BURNISHING TOOL

THE Hinsdale Manufacturing Company, 427 W. Randolph Street, Chicago, announces a unique and effective flaring tool, developed to meet the demand for perfect flares created by higher pressures and harder tubing.

Departing from conventional design, this new tool rolls and burnishes the flare to a smooth polished surface, instead of compressing it with resulting abrasion and roughness.

NEW HINSDALE FLARING AND BUSHING TOOL

This performance is accomplished by a ball-bearing cone eccentrically mounted on a shaft supported in a feed screw. Turning the eccentrically-moving cone rolls the lip of the tube against the forming-surface of a holding collet. Turning the cone shaft independent of the feed screw burnishes a flawless surface of glass-like smoothness.

This new tool quickly flares hard or soft copper tubing in sizes ranging from 3/16 inch to 3/4 inch through the use of interchange-

able hinged collets. Exceptionally small and compact for use in limited space.

The tool is furnished with ¼ inch, ⅜ inch, ½ inch and ⅝ inch collets in a metal case so small it slips into a coat pocket. Collets for 3/16 inch, 5/16 inch, 7/16 inch and ¾ inch tubing are available as extras. Descriptive literature on request.

THE "FREEZING OVEN"

FOR reasons of economy and efficiency, the unit cooler is fast replacing the old pipe coil in low temperature work (below 32 degrees). However, the problem of defrosting the low side in freezer rooms, whether pipe coils or unit coolers, has been a major one to the refrigeration industry. The defrost schemes now generally used involve three major difficulties:

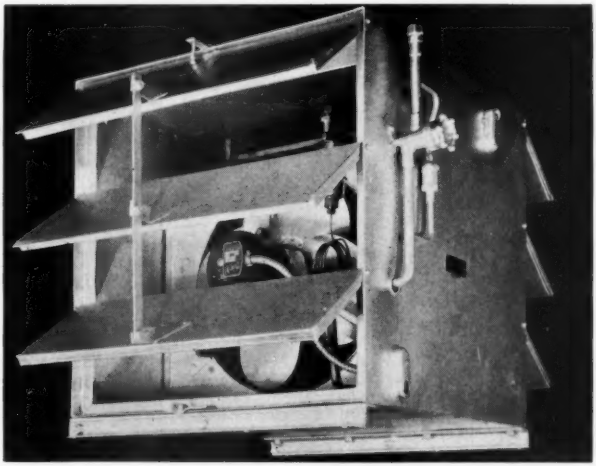
1. They require complicated and expensive hook-ups.
2. Highly skilled men are needed to perform the defrost operation.
3. There is usually a large increase in the temperature of the cooler due to the defrost process.

The "Freezing Oven" by Kramer eliminates the three principal difficulties listed above. The "Freezing Oven" is a low temperature unit cooler with a self-contained electrical defrost scheme. The complete unit is housed in an insulated shell with insulated front and rear adjustable louvers.

By shutting the suction hand valve which is mounted on the unit, closing the louvers, and turning on the electrical heater, the unit becomes an insulated electrical oven. The whole defrost process is acomplished in approximately 20 to 30 minutes without materially affecting the temperature of the cooler. The whole process is almost instant in effect and requires no special skill.

The installation is the same as any unit cooler except for the additional wiring to the electrical heater. Full installation instructions are furnished with each unit.

For a given tonnage, the Kramer "Freezing Oven" provides low temperature refrigeration at considerably lower cost than the pipe coil and offers additional value in greater space economy, more uniform distribution of refrigeration in the cooler, plus simple and quick defrost means without raising the cooler temperatures materially.



New Kramer "Freezing Oven" which automatically defrosts

Specifications for the "Freezing Oven" are: All-copper Kramer coil, ⅝ inch tube, ½ inch fin spacing, fin sweated to tube; an electrical heater of suitable wattage, suction line hand valve mounted on shell shunted by a relief valve; insulated steel housing, insulated adjustable front and rear louvers, specially designed silent fan driven by totally enclosed fan duty motor.

T. A. R. Prendible
Canada

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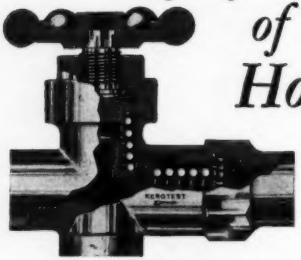
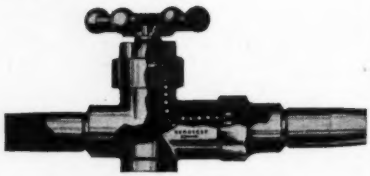
The Safety Valves of the Hour!





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Approved by many Municipal Codes

MANY of the systems you now service need approved pressure relief valves or fusible fittings to meet municipal safety codes now in effect. Two of the numerous Kerotest Safety Valves now in demand by service engineers are the combination Manual and Automatic Pressure Relief Valves Types 787 and 788 here illustrated.

These valves are available in six initial leak pressures ranging from 135 to 300 lbs. per square inch. Each rating is accurately set, individually tested at the factory and comes to you ready to install. No adjustment is required whatsoever.

For convenience in installation, a mounting flange is made directly on the body. Types 787 and 788 are available with $\frac{3}{8}$" or $\frac{1}{2}$" female pipe connections or $\frac{5}{8}$" O.D. Solder Connections. Ask your local Kerotest Jobber listed at the right to supply you with these valves of the hour.

KEROTEST

KEROTEST MANUFACTURING CO.
PITTSBURGH, PA.

The Peerless Valve

By H. J. MATTESON*

THE thermostatic expansion valve is the heart of the refrigeration system. It is used to reduce the refrigerant from condensing pressure to the suction pressure corresponding to the temperature which it is desired to maintain in the cooling coil upon which it is placed. In other words, it is the dividing line between the high and low side of the system.

The term "thermostatic" as applied to this type of valve is misleading as it does not maintain any set temperature. Correctly termed, it would be known as a "constant superheat" valve which simply means that at the point on the suction line where the control bulb is placed, the suction gas would be maintained in a constant superheated condition. The usual setting for these valves is 10 degrees superheat. Theoretically then, the refrigerant at the outlet of the coil would be completely evaporated and enter the suction line as a dry gas in a 10 degrees superheated condition.

It is the purpose of this article to discuss some of the most important requirements of a thermostatic expansion valve and how the new Peerless Model V is designed to meet these requirements.

It is naturally very important that the component parts of the thermal system be so constructed that the chance of separation of the joints with consequent loss of the thermal charge be minimized. The Peerless Model V valve has all mechanical joints, hence solder is used merely as a gas seal and is not depended upon for mechanical strength.

A. The cover is spun into the body.

B. The capillary tube is threaded into the cover.

C. The bulb is rolled tight on the capillary with a 1/32 inch radius wheel.

D. The bulb is sealed after charging by pressing a steel ball into the end of the bulb to retain the charge while soldering.

* Peerless of America Inc.

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Knoxville, Tenn. ..... Leinart Engineering Co.
London, Ont., Canada ..... Refrigeration Supplies Co., Ltd.
Long Beach, Calif. ..... L. B. Marsh
Los Angeles, Calif. ..... Refrigeration Service, Inc.
Los Angeles, Calif. ..... Refrigeration Parts Exchange
Louisville, Ky. ..... Louisville Mill Supply Co., Inc.
Lubbock, Tex. ..... R. & R. Parts & Supply Co., Inc.
Macon, Ga. ..... Lowe Electric Co.
Madison, Wis. ..... Gustave A. Larson Co.
Memphis, Tenn. ..... United Refrigerator Supply Co.
Miami, Fla. ..... Bailey-Miliam, Inc.
Milwaukee, Wis. ..... Chase Brass & Copper Co., Inc.
Milwaukee, Wis. ..... Refrigeration Specialty Co.
Minneapolis, Minn. ..... Refrigeration & Industrial Supply Co., Inc.
Minneapolis, Minn. ..... Vincent Brass & Copper Co., Inc.
Montreal, Quebec, Canada ..... Railway & Engineering Specialties, Ltd.
Mt. Vernon, N. Y. ..... County Seat Plumbing Supply Co
Newark, N. J. ..... T. W. Binder Co.
New Haven, Conn. ..... Rescoe, Inc.
New Orleans, La. ..... Enochs Sales Co.
New Orleans, La. ..... The Spangler Co.
New York, N. Y. ..... Aetna Supply Co.
New York, N. Y. ..... Melchior, Armstrong, Dessau Co., Inc.
New York, N. Y. Paramount Electrical Supply Co.
New York, N. Y. ..... The Harry Alter Co., Inc.
Norfolk, Va. ..... Noland Co., Inc.
Oklahoma City, Okla. ..... Mideke Supply Co.
Omaha, Nebraska ..... United Supply Co.
Oshkosh, Wis. ..... Gustave A. Larson Co.
Paterson, N. J. ..... White & Shauger, Inc.
Peoria, Ill. ..... Wilkins Pipe & Supply Co.
Pittsburgh, Pa. ..... Williams & Co., Inc.
Philadelphia, Pa. ..... Melchior, Armstrong, Dessau Co., Inc.
Philadelphia, Pa. ..... Victor Sales Corporation
Phoenix, Ariz. Refrigeration Supplies Distributor
Portland, Ore. ..... Bill Reiber, Refrigerative Supply, Inc.
Providence, R. I. ..... Rhode Island Supply & Eng. Co.
Rochester, N. Y. ..... Ontario Metal Supply, Inc.
Rochester, N. Y. ..... Melchior, Armstrong, Dessau Co., Inc.
Rockford, Ill. ..... Gustave A. Larson Co.
Sacramento, Calif. ..... Hinshaw Supply Co.
St. Joseph, Mo. ..... Bristol Supply Co.
St. Louis, Mo. ..... The Harry Alter Co., Inc.
St. Louis, Mo. ..... The Spangler Co.
St. Louis, Mo. ..... R. E. Thompson Company
Salem, Mass. ..... Standard Supply Co.
Salt Lake City, Utah ..... Peerless Utah Co.
San Antonio, Texas ..... Straus-Frank Co.
San Francisco, Calif. California Refrigerator Co.
San Juan, Puerto Rico. Refrigeration Supply Co.
Seattle, Wash. ..... Refrigerative Supply, Inc.
Sioux City, Iowa. National Refrigeration Service
South Bend, Ind. ..... The South Bend Supply Co.
South Bend, Ind. ..... F. H. Langsenkamp Co.
Springfield, Ill. ..... United States Electric Co.
Springfield, Mass. ..... C. P. Payson Co.
Syracuse, N. Y. Syracuse Equipment Corporation
Toledo, Ohio. The Heat & Power Engineering Co.
Toronto, Ontario, Canada ..... Railway & Engineering Specialties, Ltd.
Tulsa, Okla. ..... Machine Tool & Supply Co.
Vancouver, B. C., Canada ..... Fleck Bros., Ltd.
Washington, D. C. ..... Refrigeration Supply Co.
Waterloo, Iowa ..... Winterbottom Supply Co.
White Plains, N. Y. ..... County Seat Plumbing Supply Co., Inc.
Wilkes-Barre, Pa. ..... Radio Service Co.
Winnipeg, Manitoba, Canada ..... Railway & Engineering Specialties, Ltd.
Worcester, Mass. ..... Standard Supply Co.

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Hermetic sealing is probably of even greater importance as it reduces to a minimum the chance of losing the refrigerant charge from the entire system. Important also is the fact that there is absolutely no chance for moisture to find its way into the working parts of the valve.

Diaphragm

The Peerless diaphragm is constructed of spring temper phosphor bronze and is so backed up by the valve body that it will stand tremendous pressures without distortion or rupture. One of these valves was placed in a 350 degree oven for one hour after which it was tested and found to have its full thermal charge. It was then cut apart in a lathe and the diaphragm was found to be in perfect condition.

It would be well to keep in mind at this point first, that the oven temperature was only 39 degrees below the melting point of the solder, and second, that because of the semi-liquid charge, the total pressure on the diaphragm and cover reached in excess of one-half ton. (The valve was charged with methyl chloride.)

The body and cover are both made from solid brass forgings and it is a well known fact that a leaky forging is practically an unheard-of thing. The other brass parts are made from solid brass rod. There are no cast parts in the valve.

Orifice Construction

The Model V valve incorporates a hard stainless steel ball and a soft stainless steel seat bushing to get a tight closing, full opening orifice.

The sphericity tolerance on the ball is only .00005 inch; hence it may readily be seen that it must always present precisely the same surface to the seat and since each ball is seated to its own seat bushing, it must always remain tight.

The pressure is transmitted from the diaphragm pusher disc to the ball carrier by three brass pusher pins which insure proper centering of the ball in the orifice.

The stainless steel spring used in the Model V valve has a build-up rate of 35 pounds to the inch. Since the maximum lift of the ball with the maximum (.140 inch) orifice is .035 inch, the total maximum spring pressure build-up ever encountered with this valve is .035x35 or 1.225 pounds. Since the effective area of the diaphragm is approximately 1.75 sq. in., the maximum gauge pressure required to overcome build-up is 1.225/1.75 or .7 pounds. This low pressure requirement results in high sensitivity and smooth action. With the smallest orifice sizes the required lift is so small when using the ball type seat, that the spring pressure build-up is practically negligible.

Adjustment

Accurate adjustment is obtained through a combination of low rate of spring pressure build-up and a comparatively fine thread on the adjusting screw (24 per inch). One complete revolution of the adjusting screw on a methyl chloride valve results in approximately 1 degree superheat change, practically a micrometer adjustment.

The two factors which determine the quantity of thermal charge to be used in a semi-liquid charged valve are:

A. Volume of cover or cover capacity.

B. Bulb capacity.

The volume of charge must be greater than the cover capacity and less than the bulb capacity; hence the usual rule for determining the proper charge would be, cover capacity plus bulb capacity divided by two.

From this explanation it may readily be seen that even though the body and cover of the valve should get colder than the bulb and the cover condense full of charge, there is still charge in the bulb with which to retain full control. This is a very desirable feature, especially in low temperature work where in some cases it is practically indispensable.

Operation advantages resulting from the above described constructional features can probably best be described by showing the results of tests recently conducted by an impartial laboratory comparing a gas charged needle valve, .078 inch orifice, with a Peerless Model V, .031 inch orifice. Both valves were adjusted for 10 degrees superheat and were tested on the same hook-up, one after the other, with all load conditions being accurately controlled so that they were identical. The results are shown in the table on the next page.

From the suction pressure variation when the coil is fully loaded, it would be logical to deduce that the capacity of the .031 inch orifice with the ball type seat is approximately equal to the capacity of the .078 inch orifice with the needle type seat. This is due

	Gas Charged Needle Valve	Peerless Model V
Room Temperature	80 deg.	80 deg.
Suction Line Temperature 1 ft. outside of box	70-80 deg.	70-80 deg.
Suction Pressure Switch Setting	10-24 lbs.	10-24 lbs.
Average Suction Pressure	15 lbs.	13 lbs.
Condensing Pressure	120 lbs.	120 lbs.
Initial Pull-down Time	3.5 min.	3.75 min.
Cycles per hour	8	8
% Running Time	21.2 %	23.6%
Rate of Current Consumption (K.W.H./24 Hrs.)	2.91	2.32
Box Temperature	42 deg.	42 deg.
Suction Pressure variation when heat load was imposed which was equal to coil capacity	1 lb.	1 lb.

to the fact that the needle never lifts completely out of the orifice, while the ball type seat opens fully. Since the size of the valve is largely dependent on the necessary diaphragm size, and the diaphragm size is in turn dependent on the orifice size and required lift, it is possible to obtain a greater range of capacities with a given size valve forging when using the ball type seat. This results in a considerable saving to the manufacturer and hence to the consumer, since it cuts down the number of different size valves which must be manufactured and stocked.

From the table it will be noted that the Peerless Model V had 2.4 percent more running time than the gas charged valve, but at the same time the compressor motor consumed .59 K.W.H. less per 24 hour period, resulting in lower operating cost while maintaining exactly the same temperature conditions. This was due to the fact that the gas charged valve opened at the top of the cycle resulting in greater motor load, while the Peerless valve never opened until it had reached a suction pressure of 14 pounds which was near the bottom of the cycle.

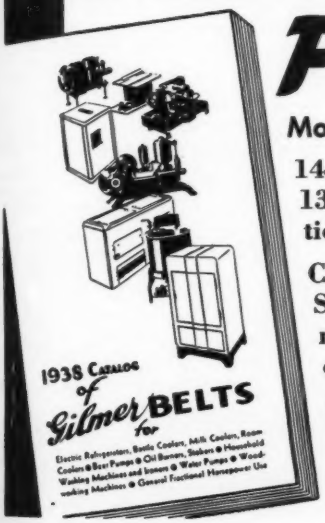
In conclusion, the advantage of the liquid charged valve is that the body of the valve may be placed in an ambient temperature either higher or lower than the bulb temperature with no danger of loss of control. The results of this test also show that the Peerless Model V does not load the compressor motor as heavily as the gas charged valve.

S S S

Harold Gollnick
Illinois

The first thing I read is the Question Box, and think it's great.

"AMERICA'S BELT BIBLE"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5th Convention and Manufacturers Exhibit

REFRIGERATION SERVICE ENGINEERS SOCIETY

BUFFALO, N. Y. NOV. 2-3-4

Three New Chapters Recorded for the Month

DURING the month of June three new chapters have been reported in the process of formation. An account of each follows.

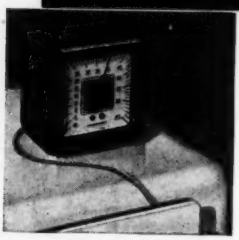
ATLANTA CHAPTER NO. 1

IN the city of Atlanta, Georgia, a recent meeting was held for the purpose of organizing a local chapter of the R.S.E.S. to be known as the Atlanta Chapter No. 1. Ten signatures were obtained for the petition for charter, with prospects of quite a large membership to be gained in the future.

Much credit can be given to Mr. Thomas L. Carnell, and Mr. C. G. Arnold of the Bowen Refrigeration Supplies, Inc., for their hard work and efforts in arranging and conducting this organization meeting.

The petition for charter has been received by the National Office and is expected to be granted very shortly.

Surely you won't try to go through another season without



the MARSH "Serviceman"

● The Marsh "Serviceman" was built to do what the pocket thermometer can't do—and it has made good in a big way. The remote reading feature enables you to make tests under actual working conditions—with the refrigerator door closed, for instance, as illustrated opposite.

When not in use the bulb and capillary tubing are neatly concealed in the case to form a sturdy compact unit which withstands rough handling and takes up little space in the kit. Note the heavy rubber buffer, completely encircling the case, which prevents damage of any surface on which it is placed and also protects the instrument.

Use the Serviceman for answering all complaints of too high or too low temperature—testing switch action—checking brine tanks and vessels—in fact, all household or commercial servicing. And do not overlook its value in selling refrigerators.

Modern facilities and volume production make it possible to sell this precision instrument (in ranges of —10° to +65° F or —10° to +100° F.) at a dealers' net price of only $5.00 F. O. B. Chicago. (Minus 20° temperature range at slightly higher price.)

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It has the "RECALIBRATOR"

The Serviceman is guaranteed accurate within one degree. If it is knocked out of adjustment simply stir the bulb in cracked ice and water and turn the Recalibrator screw until the pointer records 32°. It will then be RIGHT AT EVERY POINT ON THE DIAL.

MARSH *Refrigeration Instruments*

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"Chieftain" Quality Built Compressors and Condensing Units

are designed to give you many years of quiet, efficient and trouble free service by Engineers who have been serving the refrigeration industry for the last fourteen years.

They have again "scored a hit" with a new "V" type four cylinder compressor which is designed for use with ½ to 1 HP motors. All of the advanced features that have proven so successful in "Chieftain" household and light commercial units are now incorporated in this new four cylinder model.

Mechanical improvements include, force feed lubrication to piston pin and connecting rod bearings, positive alignment of cylinder bores with main bearings by casting cylinders and crankcase in one piece. Adjustable suction shut-off valve, interchangeable parts with single and twin cylinder models. All compressor parts are machined to precision limits on up to date equipment and assembled in glass enclosed rooms where only filtered, dust free air is admitted.

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Detroit, Mich.....J. M. Oberc, Inc.
Indianapolis, Ind.....F. H. Langsenkamp Co.
Kansas City, Mo.....Forslund Pump & Mach. Co.
Lincoln, Nebr.....Ruegg Refrigeration Supply
Memphis, Tenn.....United Refrigerator Supply
Milwaukee, Wisc.....Thermal Company, Inc.
Minneapolis, Minn., Vincent Brass & Copper Co. Inc.
Newark, N. J.....T. W. Binder Company
New Orleans, La.....Enochs Sales Company
Oklahoma City, Okla.....
...Macklanburg Brass & Copper Products, Inc.
Omaha, Nebr.....United Supply Company
Philadelphia, Pa.....Victor Sales Corporation
Richmond, Va.....Refrigeration Supply Co.
San Francisco, Cal.....Cyclops Iron Works
St. Louis, Mo.....Brass & Copper Sales Co.
St. Paul, Minn.....Thermal Co., Inc.
South Bend, Ind.....F. H. Langsenkamp Co.
Syracuse, N. Y.....Syracuse Equipment Corp.
Washington, D. C.....Refrigeration Supply Co.

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FOX RIVER VALLEY CHAPTER NO. 1

ON April 25th a meeting of refrigeration service engineers in the vicinity of Oshkosh and Fond du Lac was called for the purpose of organizing a chapter of the R.S.E.S. to be known as the Fox River Valley Chapter No. 1.

The meeting was started with a buffet luncheon, after which Mr. G. A. Larson of the Gustave A. Larson Company of Madison, Wis., called the meeting to order and introduced Mr. C. Buschkopf of Beaver Dam, Wis., a member of the National Board of Directors of the Society, who explained the Society and its purposes.

Mr. Archie of the Cutler-Hammer Co. of Milwaukee was introduced, who gave an interesting talk on domestic and commercial controls.

Mr. Irving of the Chase Brass and Copper Co. followed with a practical demonstration of the proper and improper methods of making sweat connections.

A check of the registration book showed a total attendance of thirty-seven prospective members. The meeting was terminated with an informal get-together and refreshments.

On May 9th the second meeting was held for the purpose of electing temporary officers, with the following results:

Ray Moss of Oshkosh, *president;* M. B. Guenther of Fond du Lac, *treasurer;* E. K. Wagner, of Oshkosh, *secretary;* B. W. Penewell of Oshkosh, *chairman of Membership Committee.*

On the educational program of this meeting, Mr. L. C. McKesson of the Ansul Chemical Co. gave an interesting talk illustrated with slides and motion pictures on refrigeration chemicals and dehydrants.

At this time a petition for a charter was drawn up and several signatures attached thereto.

On May 23d, after a short business session, Mr. Buschkopf suggested that the Question Box be started and that a period be devoted at each meeting for the discussion of these questions. Those in attendance found this to be a very interesting feature.

The educational program consisted of a talk by Mr. W. G. Loye of the Dayton Rubber Mfg. Co. of Dayton, Ohio, who showed a motion picture on the manufacture of V-belts and other Dayton products.

Refreshments served by Mr. G. A. Larson concluded the meeting.

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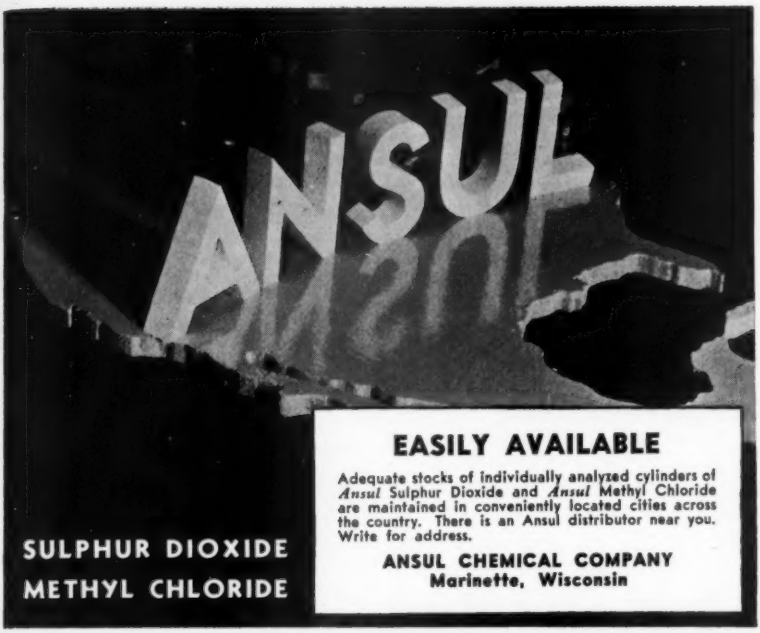

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THERMAL EXPANSION VALVE

The Only Valve That Has—

1. VELVET ACTION

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BUY THIS NEW VALVE IN QUANTITIES FROM YOUR LOCAL PEERLESS JOBBER

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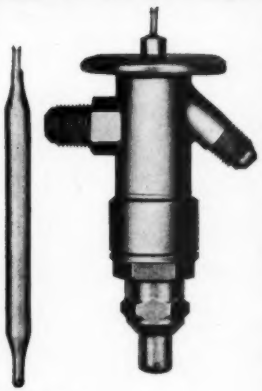

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LOS ANGELES

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CENTRAL ARIZONA CHAPTER NO. 1

During the month of April an organization meeting of the refrigeration men of Phoenix, Arizona and vicinity was called for the purpose of considering the organization of a local chapter to be known as the Central Arizona Chapter No. 1. The meeting resulted in the drawing up of a petition for charter and the attaching thereto of sixteen signatures to be presented to the National Society.

This first meeting portrayed considerable enthusiasm of the group present and it was expected that future meetings will be well attended.

Mr. J. Carl White of the Refrigeration Supplies Distributor at Phoenix is to be commended for his efforts in organizing and conducting this meeting.

MISSISSIPPI VALLEY CHAPTER PICNIC

THE Mississippi Valley Chapter of the R. S. E. S. held a picnic at Lincoln Park in Galesburg on Sunday, June 5th, for the members, their families and friends. There were about sixty who attended.

Prizes won for races and games were as follows:

Lewis Willetts—Winner of Boys' Race under the age of 10 years.

George Carsons—Winner of Boys' Race, ages 10 to 16 years.

Elna Kohl—Winner Girls' Race under the age of 10 years.

A prize of 25c was awarded each of the above winners.

Mrs. H. J. McChesney—Winner of Ladies' Race. She was awarded a water service.

Mr. Fred Tindall—Winner of Men's Race.

Mr. Tindall was also awarded 25c.

The boys of Ed Eldridge of Kewanee and John Sackey of Galesburg won the Wheel barrow Race. The prize was a cake tray.

The feature of the day was Mr. Leonard Nelson of Galesburg winning the Shoe-kicking Contest and the Ball-throwing contest. The prizes awarded were a cake tray and a water service.

The attendance prize was won by Mr. H. A. Willetts of Rock Island. This prize was $1.50 cash.

All the above merchandise prizes were donated by the Republic Electric Co. of Davenport, Iowa.

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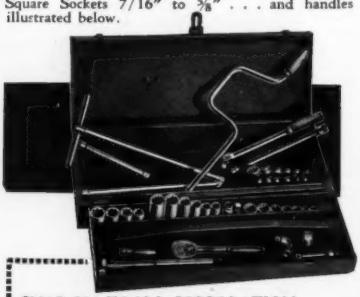
Set includes 4 types of sockets . . . 7 Double Hex, 3/8" to 3/4" . . . 6 Extra Deep Double Hex, 7/16" to 3/4" . . . 6 Double Hex Flexockets 3/8" to 11/16" for getting around corners . . . Deep Square Sockets 7/16" to 5/8" . . . and handles illustrated below.



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Available only through our own branch distributing warehouses located in 37 principal cities. See Snap-on Tools Corporation in your telephone directory or send coupon.

MISSISSIPPI VALLEY CHAPTER PICNIC

1—Women's Auxiliary. Reading from left to right, Mrs. Bengston, Mrs. Dick, Mrs. Nelson, Mrs. Tindall, Mrs. Teagarden, Mrs. McChesney, Mrs. Swails, Mrs. Cawiezell. Seated, Mrs. Willetts. 2—Mrs. Fred Tindall. Chairlady of the Entertainment Committee of the Ladies' Auxiliary. She sure can entertain. 3—Mr. Fred Tindall. Winner of men's race. 4—Mrs. H. McChesney. Winner of ladies' race. 5—Group picture of the Galesburg members of the R.S.E.S. Reading left to right, Mr. Teagarden, Mr. Stebbins, Mr. Fredericks, Mr. Carlson, Mr. Sackey, Mr. Stivers and Mr. Nelson. 6—Boys in wheelbarrow race.

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Virginia Smelting Company, keeping ahead of the times, has enlarged its facilities to anticipate growing demands of the refrigeration service field. Now, through our efficient manufacturing and sales organization we are equipped to supply all your most important replacement refrigerant requirements.

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V-METH-L
EXTRA DRY ESOTOO

CHICAGO CHAPTER

June 14th—Chicago Chapter decided to postpone regular meetings during the months of July and August, which was approved by the membership. Discussion was also held as regards preparations for the first party to be held at the fall opening in September. Also, Mr. A. Schroeder suggested the holding of a picnic in August, the date to be established later. Messrs. McPherson, F. Weir, J. Kacin, Jr., A. Schroeder, P. Bendl, P. Bossert and O. Hladilek agreed to serve on the Picnic Committee, of which Mr. Schroeder was elected chairman.

Mr. C. R. Markham of the Airo Supply Company and Mr. McPherson of the Electrimatic Valve Company—two new members—were introduced.

June 28th—President Fred Roth had the pleasure of introducing Mr. Steve Leitner, national treasurer, of Kansas City, who spoke about the national organization and commended Chicago Chapter and its officers on their manner of handling the business and activities of the chapter.

President Roth requested all of the visitors to introduce themselves, and twenty-two responded.

Mr. Pride of the Minneapolis-Honeywell Regulator Company conducted the interesting educational feature of the evening, talking on the new Polartron control made by his company. Mr. Pride introduced Mr. Newton, also of Minneapolis-Honeywell, who was one of the designers of the Polartron control, and he showed two reels of movies and explained during the showing of the movies the construction and adaptability of the new control.

This concluded the meeting for the summer, the next scheduled meeting to take place on September 18th.

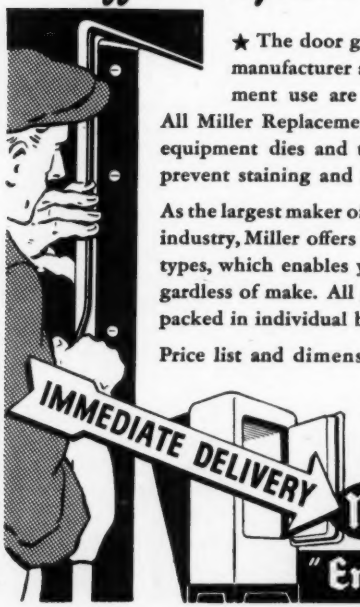
June 14th—The educational program for the evening consisted of the presentation of Mr. E. L. Tramposh's views on locker storage plants. A general discussion followed.

PITTSBURGH CHAPTER

June 10th—After a comparatively short business session the Secretary distributed Gilmer Belt catalogs to the members pres-

MILLER REPLACEMENT DOOR GASKETS

. . . Offer Original Equipment Quality



★ The door gaskets Miller supplies to the refrigerator manufacturer and those which it offers you for replacement use are "twins" insofar as quality is concerned. All Miller Replacement Gaskets are made from the original equipment dies and the rubber is specially compounded to prevent staining and for resistance to grease, aging and wear.

As the largest maker of rubber door gaskets for the refrigeration industry, Miller offers a complete replacement line of 28 gasket types, which enables you to service 80% of all refrigerators regardless of make. All gaskets are supplied in 10-ft. lengths and packed in individual boxes plainly marked as to type and size.

Price list and dimensional drawings of these 28 types can be obtained from your local jobber or by writing

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AKRON, OHIO

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ent. Then Mr. Laderer introduced Mr. Paul Domke of the Mueller Brass Co., who gave an interesting lecture and demonstration of the streamline fittings and the method of soldering them. Much appreciation was shown by the membership for this presentation by Mr. Domke.

LOS ANGELES CHAPTER

May 27th—Mr. J. F. Swinger of the Burroughs Adding Machine Co., was introduced by Mr. E. Blair, chairman of the Educational Committee, and Mr. Swinger spoke on the subject, "Why Keep Books."

Next Mr. Armstrong of the Penn Electric Co. was introduced, who, with the aid of several working models, demonstrated the operation and construction of the various Penn controls.

Following this was a general discussion concerning the federal excise tax.

ST. LOUIS CHAPTER

May 26th—Mr. E. Gygax, chairman of the Educational Committee, introduced Dr. W. O. Walker, research engineer of the Ansul Chemical Company, who spoke on the subject of dehydrating agents, illustrating his talk with figures and lantern slides showing the actual effects of moisture on various metals commonly used in refrigeration systems. The final conclusion drawn from Dr. Walker's talk was that no present dehydrating agent is 100% effective in the removal of moisture, some agents having little or no effect at all.

Following his talk a motion picture was shown illustrating what can happen in methyl chloride systems where aluminum coils or parts may come in contact with the gas.

WICHITA CHAPTER

June 3d—This meeting was held in the Home Economics Room or model kitchen, of the Kansas Gas and Electric Co., who kindly donated the space.

After the usual routine of business was dispensed with, the question box was opened and an interesting discussion on the questions submitted followed. Much can be learned from the discussion of these questions and they are found to be of highly educational value.

DAYTON CHAPTER

May 27th—Mr. G. Click and C. Dennis reported on the progress of their plans for

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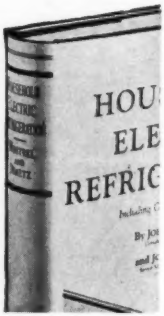
How to install, service, and repair all types of household refrigerators.

This book presents everything needed by the man who is servicing electric refrigerators, from a simple explanation of how they work to detailed, practical methods and data on installation, testing, servicing, adjusting, trouble-shooting, repairing, etc.



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Including Gas Absorption System

By Wostrel and Praetz

406 pages, illustrated, $4.00

A practical manual for installation and refrigeration service men, giving descriptions and illustrations of many popular makes of machines, showing both the entire system and details of parts, and emphasizing the basic points of construction and operation. Besides the step-by-step descriptive material, numerous charts and tables giving reference information in handy form make this a practical book.

Nickerson & Collins Co.

435 N. Waller Ave., Chicago

the meeting to be held in Springfield, Ohio, in the latter part of June. Plans are going ahead rapidly and it is expected that a nice turnout will be obtained.

In the absence of the Educational Chairman, open discussion on service troubles and remedies was held and proved to be very educational.

June 10th—Announcement was made and the Secretary requested to notify all members that the next meeting would be held June 24th in Springfield, Ohio. All members were urged to make every effort to attend in order to produce as large a meeting as possible.

The meeting was then turned over to Mr. H. Shoupp for the educational feature of the evening.

MISSOURI VALLEY CHAPTER

April 7th—Mr. Thomas McKee, Jr., of the Detroit Lubricator Co., gave an interesting and instructive talk on Detroit Lubricator valves.

Arrangements for the next regular meeting, including a motion picture of an educational nature to be shown and a door prize of $5.00 for members only, was announced. Refreshments will be served following the meeting.

April 21st—The first party of the Missouri Valley Chapter was held on this date at the Nebraska Power and Light Co. service building, with seventy persons attending.

The door prize of $5.00 was won by Mr. Stanley F. Welna.

Several moving pictures were shown, of both an educational and comedy nature.

Refreshments were served by a committee consisting of Mr. T. R. Cherry, Mrs. R. Walbridge, Mrs. G. Eacher and Miss Elizabeth Neuberger. After refreshments had been served, all remaining articles of food were raffled off. The bidding on these articles was quite high and exciting.

TRI-STATE CHAPTER

April 18th—On the educational program for the evening, Mr. Roscoe of the Chase Brass and Copper Co. was introduced as the speaker and gave a very fine demonstration of the proper method of soldering hard drawn copper tubing and fittings, which was greatly enjoyed by all those present.

Some discussion followed on the probable educational programs to be secured for the summer meetings.

May 2nd—After a short business session, President Brunton introduced Mr. Hill of the Mueller Brass Co., who in turn introduced as the speaker of the evening Mr. Paul Domke of his company. Mr. Domke proceeded with a talk and demonstration on the Mueller line of valves and fittings and the proper method of soldering streamline fittings.

ONTARIO FOREST CITY CHAPTER

April 13th—At the conclusion of the business session of the meeting, Mr. Switzer of the MacKinnon Industries of St. Catherines was introduced as the speaker of the evening. Mr. Switzer's subject was the various types of motors and their specific applications, with particular reference to capacitor types manufactured by the Delco Light Co., which is produced in Canada by the MacKinnon Industries.

April 22nd—This night was devoted to a stag party at the Buchan House and a very interesting program of entertainment was enjoyed by those in attendance. The entertainment consisted of exhibition dancing and magician acts, followed by games provided by the members.

May 13th—Due to the increasing press of business on most of the members, only one meeting was held for the month of May. This meeting was also to be the last of the season, the next being scheduled for September 23rd.

The balance of the meeting was turned over to the new incoming officers and devoted to remarks from each on the acceptance of their offices. The new officers elected are: C. O. Cunningham, *president;* S. O'Brien, *1st vice-president;* C. Overholt, *2nd vice-president;* R. A. Campbell, *secretary;* R. A. Wright, *treasurer;* W. R. Bevis, C. F. Curtis, F. A. M. Dawson and R. F. Harvey, *directors;* E. H. Albrough, *Educational Committee chairman;* J. J. McCaughey, *Entertainment Committee chairman;* J. F. Yeddeau, *Membership Committee chairman.*

S S S

THE "CONTRIBS' COLYUM"

by THE KINGFISH

IT'S now "Sandy Mc'' Goldberg. Herman Goldberg was officially awarded his new name when, in company with several gentlemen at the bar in the Capitol Hotel, Madison, Wis., he offered to set them up for the house at 12:01 A.M. when he knew that regulations required the bar closed exactly at midnight.

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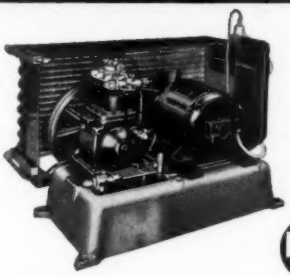

M & E Bare Compressors and complete units, available with or without motors and controls, meet every need of the Assembler or Service Company with high quality, moderately priced.

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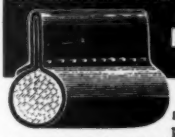
FOR ALL MAKES REFRIGERATOR DOORS



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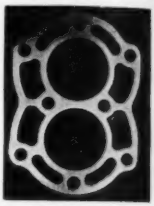

Metallic Gaskets that hold regardless of what the refrigerant may be and will not shed particles of material to clog up important working parts in a machine.

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The members of the Mississippi Valley Chapter of the R. S. E. S. take their hats off to the Galesburg, Illinois, members who made such a big success of the picnic held on June 5th.

Ball playing by Ed Eldridge of Kewanee, Illinois, was the best seen for some time and the home runs made by Fredericks of Galesburg were the deciding factors of the game. The Galesburg men made up one team and the other members the opposing team. The Galesburg men won by a score of 94 to 88.

Hats are also off to the McChesneys who drove all the way from Sterling for the picnic. They said they certainly enjoyed being with the bunch.

Central New York Chapter is happy to report that their genial treasurer, Mr. Paul Cross, is the father of a bouncing baby girl.

* * *

Sal France
New York

Find enclosed $2.00 for two REFRIGERATION SERVICE ENGINEER Binders, as I think these little service books are worth much more than some so-called manuals.

A SERVICEMAN'S TRIP TO DENMARK

I HAVE just returned from a three months' vacation to Denmark, and I thought it might interest the readers of THE REFRIGERATION SERVICE ENGINEER.

It was my first trip home in 24 years and, of course, a good many things had changed in that time. First of all, I noticed that the standard of living was just as high as ours. People live well, and eat well—in fact, too well. The Danish sandwiches are appetizing and delicious, and they drink a lot of good beer along with them.

The first thing you notice when you get out on the street are the many bicycles.

Pictured on Page 63

1—Typical farm house in Denmark
2—Street scene in Copenhagen
3—A rough day, judging by the seasick ones leaning over the rail
4—Taken from a high bridge in Denmark

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G.E.—Westinghouse and Majestic

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HOW MUCH CH_3Cl or SO_2 or NH_3 CAN YOU ABSORB?

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The Cesco Healthguard Fume Kit makes you immune. It is adjustable, light, soft, durable, comfortable and—inexpensive. Comes ready equipped with cartridges for Methyl Chloride (CH_3Cl), Sulphur Dioxide (SO_2), Ammonia (NH_3). Write for particulars and price, today.

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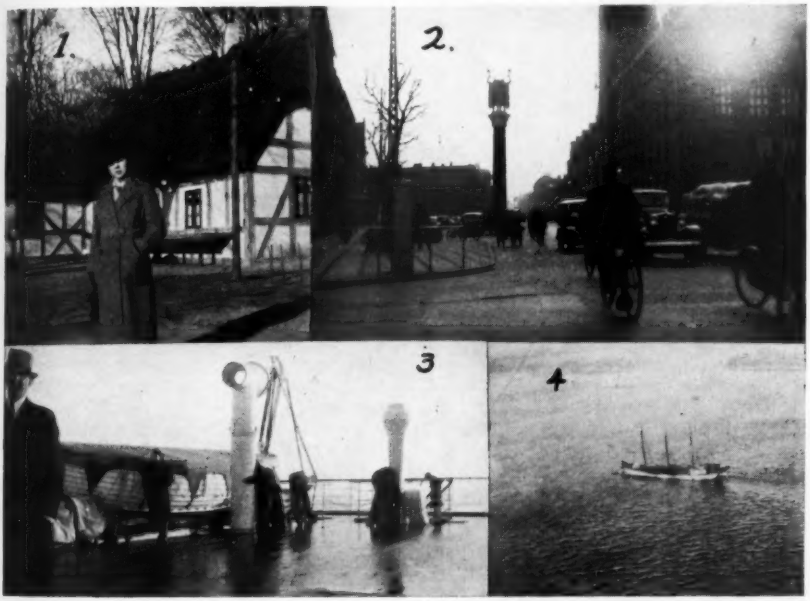

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The gasket illustrated is for older models of GENERAL ELECTRIC and FRIGIDAIRE. It fits. All JARROW gaskets are built to Manufacturers' original specifications. Insist on JARROW GASKETS.

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THE DIFFERENCE is the fact that they are made to precision standards without inside wrinkles, buckles, or other capacity-decreasing obstructions.

They are tested to 400 lb. air pressure, thoroughly dehydrated and then sealed before shipment. Thus, we eliminate leakage or condensation troubles, and make satisfaction certain. Write for data—

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Everyone from 4 to 80 years old rides them. Automobiles are not as common as here. They are considered more of a luxury, and the distances are so short, they don't need them as we do. A Ford or a Chevrolet costs about $1600 due to a high import tax. Railroad fares are rather cheap. I bought a ticket for $7.50, and it entitles one to travel all over the country, night and day, if you wish, for eight days. It gives a visitor a good chance to see the country from one end to the other.

I visited and inspected the Sabroes manufacturing plant in Aarhus, one of the oldest and largest refrigeration equipment manufacturers in the country. They have been in business since 1897, and are still going strong. They make some mighty nice machinery, both domestic and commercial, ranging in size from a ¼ hp. to 100 hp. In fact, I was rather impressed when they showed me all through their plant. I spent all day visiting with the chief engineer, and they were very courteous. Their equipment is installed all over the world, including some tropical countries. About 600 installations have been made on board ships of all descriptions. The gases most commonly used are carbon dioxide, ammonia and Freon. They also make their own coils, of all descriptions, as well as refrigerator boxes, walk-in coolers, and counters. Cork insulation is used throughout. Automatic valves and thermostats, as well as motors, are also made in Denmark, but by another concern. Domestic refrigeration is not going so well as yet. People have not been educated to the advantages of electric refrigeration, and the prices are rather high. A five cubic foot job costs about $250 to $300, and is sold with only one year's free service.

Frigidaire is pretty well represented, especially in commercial jobs, but due to a high import tax, to encourage home manufacturers, they have had a set-back in the last few years.

I was rather surprised to find so many people who could speak English. Perhaps it is due to the business relations with England, and also the many American films shown over there with English talkies. I went to five movies, and four of them were American films. When one goes to the night clubs, you hear American tunes played half the time. Once they played the

You'll find a lot of use for Manufacturers' new complete catalog

Write for your copy today . . . *listing for service men* . . . Fin coils of copper, aluminum and steel . . . blowers . . . ice cube makers . . . *Cascade* drip pans . . . bare pipe coils . . . Estimates promptly furnished, no charge.

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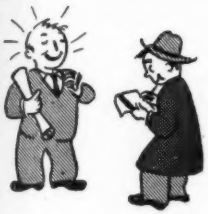

That Blythe's new catalog is the best ever, everything the service man needs is conveniently arranged . . . many new items for air conditioning and refrigeration . . . complete stocks of standard parts, tools and supplies . . . new low prices . . . same day shipment on your orders . . . Write today on your letterhead for a copy.

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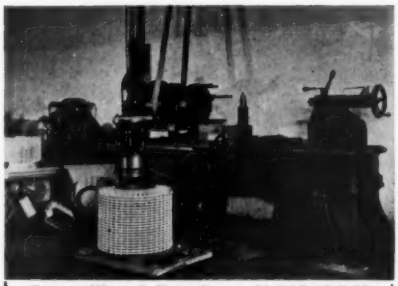
Star Spangled Banner, and everyone stood up while the orchestra played.

The Danes drink a lot of beer, and it is good beer, too, but it is not cooled properly. I should think someone would go over there and sell them the idea of installing some of our beer cooling equipment. I am sure he could sell a lot of this equipment because they have the money. They do a good business. When one goes into a restaurant, they don't serve you a glass of water with your meal. They expect you to order a glass of beer instead, as everyone usually does.

One of the things that impressed me most was their Old Age Pension System. When men or women reach the age of 65, they can retire from active work and move into the old age home, if they so desire, and they are taken care of just like they would be in a first-class hotel. They all have their own rooms, and man and wife live together. They have four meals a day, served in their rooms, with a two-course dinner, and there is a nice hospital connected right with the home. They are well taken care of, and we need something like that in this country. It is all paid for through the income tax, which is about 8 to 10 percent of your



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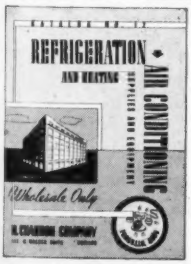

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Detect This Trouble and You Discover a SURE SALE and NEW PROFITS!

Trouble in the cooler! Dead air spots and freezing zones are impairing foods . . . Humidity, too high or too low, is causing still more grief . . . That's the time for the Service Expert to recommend — demonstrate — install Action-Air System. Action-Air is a patented system of correct air circulation for coolers. A demonstration sells it. Pays its own way through savings. Makes good profits for you and leads to repeat business. Proved in many uses since 1932. Write for attractive proposition. THE BROWN CORP., 614 Bellevue Ave., Syracuse, N. Y.

ACTION-AIR SYSTEM

income. It is also compulsory that you belong to a sick benefit association, so when you are sick you have free hospital and doctor care.

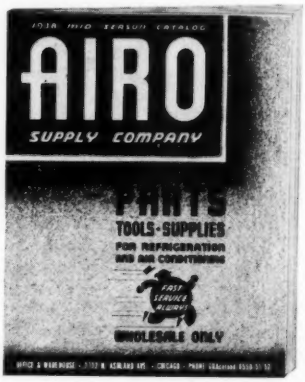
The Danes are highly organized. You have to belong to a union to work at any trade. A law was just passed, whereby everyone has to have two weeks' vacation with pay each year.

The farmer sells and buys all of his products through cooperative stores. Milk sells for eight cents a quart, and the farmer receives four cents a quart. The farms are all well kept up, neat and clean, and most of them have electricity.—*Fritz Harder, Electric Refrigerator Service, Syracuse, N. Y.*

NEW CATALOGS AND BULLETINS

AIRO SUPPLY COMPANY, 2732 N. Ashland Ave., Chicago, Ill., announces the release of their 1938 Mid-Season Catalog of Air Conditioning and Refrigeration Parts, Tools and Supplies. Following the policy established last year, the Airo catalog contains list prices throughout.

Twelve new pages have been added to make it the largest and finest catalog ever presented to the trade by the Airo Supply Company. Chicago Seals, Gilmer Belts,



Arco Fittings, and Kerotest Valves are among the new items added to the line.

Catalogs are sent on request to dealers and servicemen connected with the air conditioning and refrigeration industries.

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POSITIVE CONTROL LIQUID COOLERS

COLTROL D-X *(Left)* a dry-type instantaneous cooler, and COLTROL *(Right)* a brine-type cooler. Both types give you perfect temperature control and perfect foam control. Either fits standard beer coil box. All refrigerants. Permits steam or chemical cleaning of beer coils. A source of quick profits for you. See your Jobber or write direct.

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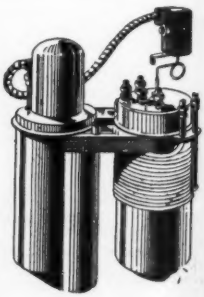

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A midget with the pull of an elephant. Every serviceman and shop needs one. High grade steel. Sturdy, compact, light weight (2 lbs.). Meets practically all requirements, where a puller is used. Changeable from three to two arm puller, almost instantly.

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FLUSHING REFRIGERATION CO.

133-22 41st Ave. FLUSHING, N. Y.

Rotary Seal Company, 809 W. Madison Street, Chicago, Ill., has issued a new 47-page pocket-size manual and catalog of replacement seals for electric refrigeration.

In this book are given detailed illustrated instructions for the proper installation of the various seals. Model numbers and specifications for approximately 100 replacement units are shown.

Instructions are also given for the proper method of ordering other units not listed, showing the dimensions and other information required.

This book contains useful data for every service engineer. Copies may be secured through jobbers.

Hasco, Inc., Greensboro, North Carolina, has just released two catalogs to the refrigeration service field. First of these is an 84-page parts and supply catalog, listing, in addition to the usual line, a complete line of change-over equipment for Frigidaire machines.

The second catalog deals exclusively with Hasco's renewal service on all refrigeration parts and assemblies. It is a 16-page book, offering many services of value to nearly every service engineer. Both catalogs are now available on request.

California Refrigerator Co., 1077 Mission St., San Francisco, Calif., has issued a new 260-page catalog of refrigeration and air conditioning parts, tools and supplies.

More than 6,000 items, with 1,200 illustrations, are contained in the book, giving among other things, the most complete list ever published on gaskets and belts.

Prices shown are all list prices, with a 19-page discount section in the back of the

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Revolutionary in design this New Hinsdale Flaring and Burnishing Tool actually rolls and burnishes the flare to a smooth polished surface instead of compressing it with resulting abrasion and roughness.

One tool flares both hard and soft copper tubing in all standard sizes from 5/16" to ¾" O.D. Incredibly small, compact and easy to use in tight places. Write for literature.

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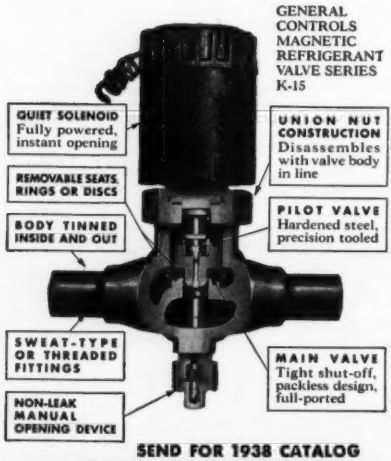
INSIDE FACTS


GENERAL CONTROLS MAGNETIC REFRIGERANT VALVE SERIES K-15
QUIET SOLENOID Fully powered, instant opening
UNION NUT CONSTRUCTION Disassembles with valve body in line
REMOVABLE SEATS RINGS OR DISCS
PILOT VALVE Hardened steel, precision tooled
BODY TINNED INSIDE AND OUT
SWEAT-TYPE OR THREADED FITTINGS
MAIN VALVE Tight shut-off, packless design, full-ported
NON-LEAK MANUAL OPENING DEVICE

SEND FOR 1938 CATALOG

GENERAL CONTROLS
1503 Broadway, Cleveland, Ohio — 1370 Harrison St., San Francisco, Calif.
207 5th Ave., New York City, N.Y. — 450 East Ohio St., Chicago, Ill.

book, which shows the list and net price for every item, making it unnecessary for the service engineer to figure his own discount.

Copies of the catalog may be obtained from the company at the above address.

GUSTAVE A. LARSON CO., of Madison, Wis., with branches in Oshkosh, Wis., and Rockford, Ill., announce their latest parts and supplies catalog to the refrigeration and air conditioning trades.

The book consists of 104 pages, well printed on a good grade of paper, attractively covered in a blue and yellow cover. The catalog lists every replacement part, service tool, new equipment or material needed in the refrigeration field. In addition to this, it contains much useful information, such as: tables, conversion factors, insulation data, brine mixtures, weights and measures, temperature-pressure relation charts, and much more useful data, which make the book a good reference manual in the field. Space is also devoted to the encouragement of men engaged in refrigeration work to join the Refrigeration Service Engineers Society.

All prices shown are list prices, with a detachable discount sheet in the front so that the catalog may be used as a sales book, and shown to your customers. Stores are located at: 205 E. Main St., Madison, Wis.; 50 Market St., Oshkosh, Wis.; and 213 S. Winnebago St., Rockford, Ill. Obtain your copy from any of these locations.

REMPE COMPANY ADDS TO ENGINEERING STAFF

MR. A. G. VOGEL has joined the Rempe Company, Chicago, as assistant to Mr. J. O. Schultz, chief engineer of the company, in charge of development and sales work.

Mr. Vogel was formerly with Crane Company, having joined that organization in 1928, in the Drafting and Engineering Department. His work consisted principally of the design and layout of piping for power plants, high pressure, steam and general plant work, also, heat transfer problems for general industrial applications. While joining Crane Company in 1928, his duties from 1935 to 1938 included the handling of all refrigeration inquiries and problems for the Crane Company branches all over the country.

In his new position, Mr. Vogel will concentrate his efforts and experience on the

A. G. VOGEL

Locker Plant and Fin Coil Division of the Rempe Company, as well as on the new line of Rempe cooling units.

* * *

A. R. BOWMAN APPOINTED REPRESENTATIVE FOR JAS. P. MARSH CORP.

JAS. P. MARSH Corporation announces the appointment of A. R. Bowman, 703 Temple Bldg., Tel. Stone 2419, Rochester, N. Y., as their representative in the sale of Marsh steam specialties, air valves, gauges, thermometers and industrial instruments for the Rochester territory.

* * *

MIDWEST SUPPLY JOBBERS HOLD MEETING

THE Midwest Refrigeration Supply Jobbers Association met at the Hotel Fort Des Moines in Des Moines, Iowa, on Sunday, June 19th.

Mr. C. W. Dennis of the Refrigeration Supply Company of Sioux City, Iowa, and the Dennis Refrigeration Company of Des Moines, Iowa, was elected President and Mr. E. L. Bengston who is manager of the Refrigeration Supply Department of the Republic Electric Company of Davenport, Iowa, was elected Secretary and Treasurer. They will serve for a period of one year beginning July, 1938, to July, 1939.

There were several conventions being held at the Hotel Fort Des Moines and the Chiropractic Convention seemed to be mixed up with the jobber meeting. Several times Chiros came into the room and wanted to know is it was the Chiro meeting. They were given the correct information and directed to their own meeting place.

LOOK AT THE PLUS + VALUE OF Artic

REG. U. S. PAT. OFF.

(DU PONT METHYL CHLORIDE)

1. Small volume displacement per unit of refrigeration permitting the use of small, compact equipment.
2. Not corrosive to ordinary equipment.
3. Operates at positive pressures, even at sub-zero temperatures.
4. Fast cooling and quick freezing.
5. Gives controlled low temperatures easily and efficiently.
6. Thermally stable and does not decompose at any temperature existing in the refrigeration system.
7. Has low head pressures, adaptable to air-cooled condensers and light-weight equipment.
8. Economical power.
9. Handled, serviced with ease.
10. Easy to "hold" — comparatively low leakage.
11. Easy to engineer—no unusual design problems.

ARTIC—*the Preferred Methyl Chloride for Service Work*

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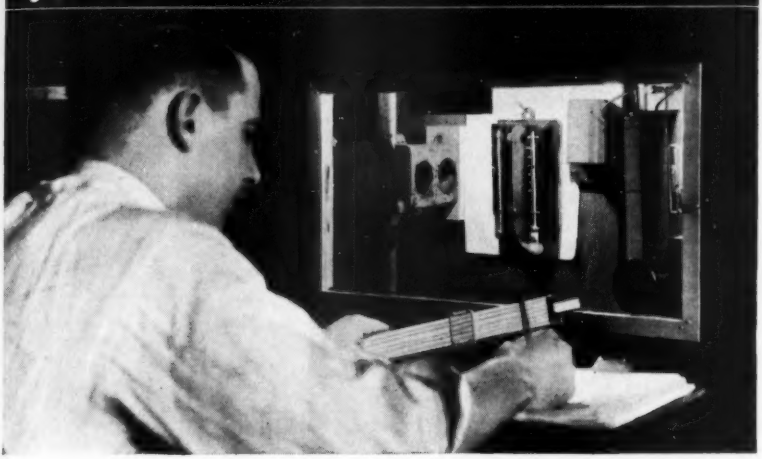

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North, East, South, West

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Al. Miller, 885 Stebbins Ave.

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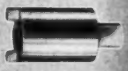

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